Christine

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

Reply To
Attn Of: OW-134

JUL 18 2000

David Mabe, Administrator
State Water Quality Programs
Idaho Division of Environmental Quality
1410 N. Hilton
Boise, Idaho 83706-1255

Re: Middle Fork Payette River Sub-basin Assessment and TMDL (HUC: 17050121)

Dear Mr. Mabe:

The U.S. Environmental Protection Agency (EPA) is pleased to approve the Middle Fork Payette River TMDL submitted to us on December 31, 1998, as revised on December 23, 1999, for the following parameters:

Waterbody	Segment	Parameter
Middle Fork Payette River	Big Bulldog Creek to SF Payette River	sediment

We look forward to implementation of the TMDL, and continuing to work collaboratively on water quality issues in the Middle Fork Payette watershed.

By EPA's approval, this TMDL is now incorporated into the State's Water Quality Management Plan under Section 303(e) of the Clean Water Act. If you have any comments or questions, please feel free to call me at (206) 553-1261, or you may call Leigh Woodruff of my staff at (208) 378-5774.

Sincerely,

for Randall F. Smith
Director
Office of Water

cc: Michael McIntyre, IDEQ
Don Essig, IDEQ
Steve West, IDEQ

IDAHO DEPARTMENT
OF HEALTH AND WELFARE
DIVISION OF
ENVIRONMENTAL QUALITY

1410 North Hilton, Boise, ID 83706-1255, (208) 373-0502 Philip E. Batt, Governor

31 December 1998

Randall Smith, Director
Office of Water
United States Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Dear Mr. Smith:

Enclosed you will find the Middle Fork Payette River Sub-basin Assessment and Total Maximum Daily Load (TMDL). The required public comment response has been included as Appendix C. This constitutes a formal submission to the United States Environmental Protection Agency of the Middle Fork Payette River TMDL in accordance with the State of Idaho Eight (8) Year TMDL Schedule, the Clean Water Act, Idaho state water quality standards, and Idaho Title 39, Chapter 36 *et seq*.

The Division of Environmental Quality feels that the Middle Fork Payette River TMDL, as it is currently constituted, meets all the necessary criteria under §303(d) of the Federal Clean Water Act as a total maximum daily sediment load for the Middle Fork Payette River. Therefore, this document is submitted for your approval. The following list provides a guide to sections of this TMDL which address the required elements as identified by Bruce Cleland in a November 19, 1997, meeting between the IDEQ and EPA.

1) Applicable Water Quality Standards:	Sections 2.2 and 2.3
2) Loading Capacity:	Section 3.2
3) Source Identification:	Sections 2.3 and 3.2
4) Technical Assessment:	Section 3.2
5) Allocations:	Section 3.2
6) Margin of Safety:	Section 3.2
7) Public Participation:	Sections 4 and 5

Sub-basin Assessment and Total Maximum Daily Load for the Middle Fork Payette River

Boise Regional Office
Idaho Division of Environmental Quality
December 1998

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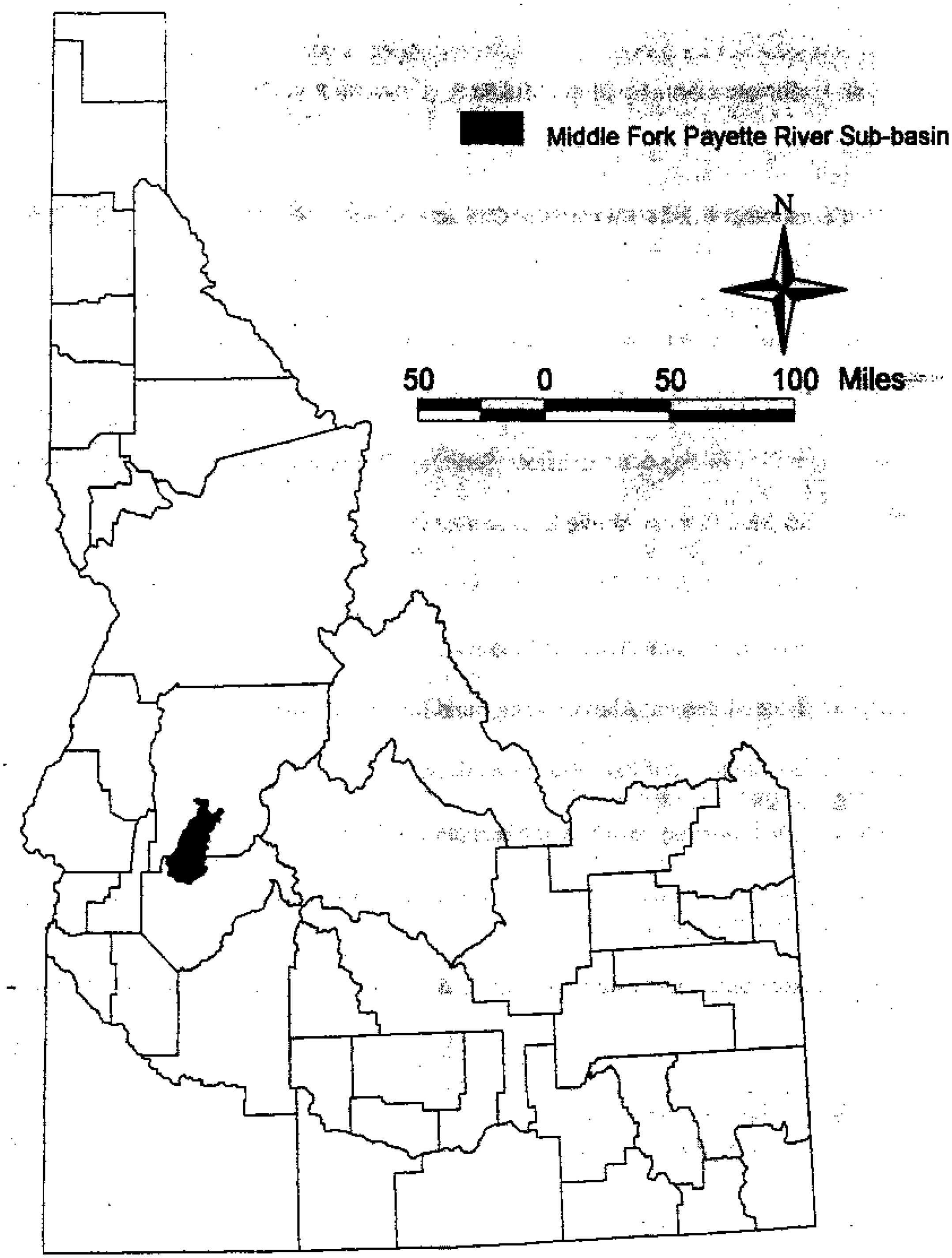


Figure 1: Middle Fork Payette River Location Map

2. Sub-basin Assessment

2.0. Middle Fork Payette Water Quality at a Glance

Water Quality at a Glance:

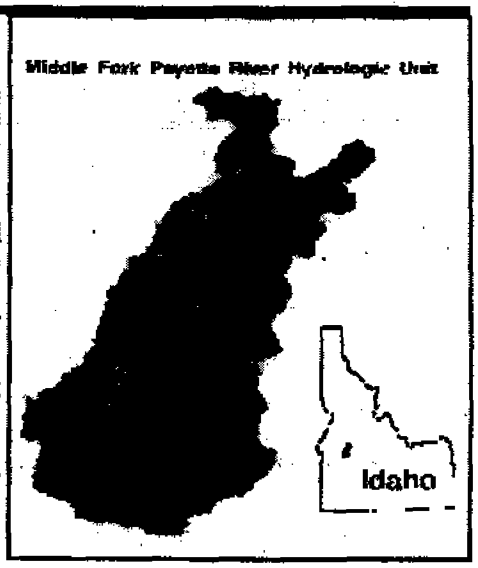
Hydrologic Unit Code 17050121

Water Quality-Limited Segment ....
.... MF Payette River from Bulldog Creek to Mouth

Beneficial Uses Affected .... ColdWater Biota

Pollutant of Concern .... Sediment

Known Land Uses .... Forestry, Agriculture, Urban



2.1. Characterization of Watershed

The Middle Fork Payette River is located in central Idaho, about 64 km (40 mi) north of Boise. The Middle Fork Payette river generally flows south, south-west, through the town of Crouch, ID. The South Fork Payette joins the Middle Fork downstream of the town of Crouch to form the main stem of the Payette River. The Payette River then flows generally westward until Banks, ID, where the North Fork Payette River joins it. From Banks the Payette River flows west and south-west through the Idaho communities of Horseshoe Bend, Emmett, Payette until it reaches the Snake River near Ontario, OR.

2.1.1. Physical and Biological Characteristics

2.1.1.1. Climate

The Middle Fork Payette River basin is located in the Northern Rocky Mountain physiographic province at the western edge of the Salmon River Mountains. Local climate is characterized as continental with occasional maritime weather mass intrusions. The annual weather cycle consists of cold winters and warm summers where gradual changes of season are marked by rapid changes in weather.

During the winter and early spring months warm, humid air masses can enter the region causing rapid snow melt which, when combined with rainfall, create saturated soil conditions and high stream flow events. These climatic events, also called rain-on-snow events, occur periodically and can trigger large and/or numerous landslides. A large rain-on-snow event during the winter of 1997 resulted in numerous landslides within much of the Middle Fork Payette River basin. These recent landslides greatly influence the current sediment load within the basin.

The nearest long-term temperature and precipitation monitoring stations are located at Garden Valley, Lowman, and Deadwood Summit. The weather stations located at Garden Valley and Lowman have a period of record from 1948 to present. Deadwood Summit weather station has a period of record from 1936 to present.

As typical for mountainous, continental climates, the Middle Fork Payette has warm summer days and cool nights. Summer thunderstorms are often intense events accompanied by heavy rainfall, hail, and lightning. Night-time temperatures can be below freezing beginning in September. Winter days and nights are cold with snowfall beginning in late-October and lasting through March. Average monthly maximum daily temperatures range from 0.6°C (33 °F) in January to 34°C (93 °F) in July, while average monthly minimums range from -8°C (18 °F) in January to 9°C (48 °F) in July at elevations of 975 meters (3200 feet). Mean temperatures average 5 °C (9 °F) cooler at elevations above 1615 meters (5300 feet) and 7 °C (13 °F) cooler at elevations above 2000 meters (6562 feet). The snowfall accounts for about 60% of the annual precipitation.

Climatic conditions within the Middle Fork Payette were estimated using linear relationships derived from average annual data collected at these three stations (IDEQa, 1998). The following list summarizes the basic climatic characteristics representative of the high (2091 meters, 6860 feet), middle (1212 meters, 3976 feet), and low (978 meters, 3208 feet) elevation portions of the watershed:

Table 1: Climate Summary of the Middle Fork Payette River

	Elevation (m/ft)	Average Annual Air Temperature (°C/°F)	Average Annual Precipitation (mm/in)	Average Annual Snowfall Depth (m/ft)
Upper	2091/6860	1.0/34	950/37	7.0/23
Middle	1212/3976	6.4/44	689/27	2.7/9
Lower	978/3208	7.9/46	650/25	1.5/5

2.1.1.2. Hydrography

The Middle Fork Payette River watershed has predominantly a southerly aspect with side drainages facing generally east and west. The South Fork Payette River joins the Middle Fork Payette River one mile south of Crouch, Idaho to form the Main Payette River. This section between the Middle Fork Payette River and North Fork Payette is locally and commonly referred to the South Fork of the Payette . The Middle Fork Payette River drains 756 km^2 (292 mi^2) (USDA 1976). The river is nearly 74 km (46 mi) long, excluding numerous tributaries within the sub-basin.

The valley cross sections within the Middle Fork Payette are usually deep, V-shaped in the mountainous upper elevation, shallow and rounded at mid-elevations, and become very wide within the lower valley near Crouch where deposition dominates the valley formation. The stream channel varies from Rosgen "B" type in the upper watershed to a "C" type in the lower watershed. The elevation of the stream is commonly bedrock controlled. The "B" channels are generally transport reaches and are dominated by particles of a bimodal distribution. Many particles are of boulder and large cobble sized, the second group is primarily sand sized or smaller sized particles. The "C" channels are generally deposition reaches and are dominated by sand sized or smaller sized particles.

The annual peak flow events often correspond with periods of maximum snowmelt and rain-on-snow events. Peak flows that result from spring snowmelt typically occur from April to June with the majority of runoff coming from higher elevations in late May and early June. Rain-on-snow events typically occur from January through March.

Rain-on-snow related melt and high flows typically occur below elevations of 1981 m (6500 ft). High-intensity summer thunderstorms can result in surface runoff and localized flooding from disturbed areas in smaller drainages.

About 61% of the precipitation exits the Middle Fork Payette Sub-basin as streamflow (USGS, 1998; Western Regional Climate Center, 1998). Springs and seeps in the sub-basin vary in size, source, and location. Constant flowing springs and intermittent seeps occur in areas of well-fractured bedrock, mostly in areas of north-facing toe slopes. Seeps are common at mouths of secondary drainage ways where surface waters flow intermittently in spring. Hot springs are usually in the bottoms of major drainages and associated with fault zones.

Numerous water body naming systems have been used over the years. The Idaho Division of Environmental Quality (IDEQ) and the Idaho Department of Water Resources established Water Body Identification (WBID) numbers for waters in the state. This numbering system was used to identify specific waters. Slight modifications of the numbering system were made to ensure unique WBID numbers statewide. Table 2 provides some commonly used water body numbering systems.

Sixth field hydrologic units (sub-watersheds) identified within the Middle Fork Payette can contain several identified waters, and thus have more than one water body identification numbers associated within them. Names of the sixth field hydrologic units within the Middle Fork Payette are illustrated in Figure 2.

2.1.1.3. Geology, Soils, and Landforms

The Middle Fork Payette River basin is located within the southern Idaho Batholith and is dominated by forest vegetation. The terrain within the sub-basin varies from wide valley bottoms to steep hillsides with elevations ranging from 975 meters (3200 ft) to 2652 meters (8700 ft). The Middle Fork Payette River sub-basin is within the Northern Rocky Mountain physiographic province (USDA, 1976).

The Middle Fork Payette River sub-basin is near the western boundary of the Idaho Batholith (Figure 3). The Idaho Batholith is a granitic intrusive body that extends 483 km (300 mi) in a north-south direction and ranges from 129 km (80 mi) to 193 km (120 mi) wide. The batholith is composed of two lobes: the Bitterroot lobe to the north and the Atlanta lobe in the south, which includes the Middle Fork Payette River sub-basin. This area of Idaho is underlain by Cretaceous and Tertiary age intrusive rocks. Older plutons emplaced during the Cretaceous time were extensively faulted and then intruded by epizonal plutonic rocks and dike swarms. The Cretaceous batholith was exposed at the surface by Eocene time and lower extrusive units were later deposited on the surface. Rock composition of the batholith ranges from quartz gabbro to granite with the most common rocks consisting of granodiorite and quartz monzonite. The dominant rock type in the Middle Fork Payette River sub-basin is a two-mica granite (Muscovite-Biotite Granite).

Table 2. Middle Fork Payette River Water body Identification Numbers*

Idaho Water Quality Standards	Pacific Northwest Rivers System	Water Body Identification Number	Major Tributary
SWB-322	703.00	ID-17050121-01	Middle Fork Payette River
		ID-17050121-03	
		ID-17050121-04	
		ID-17050121-06	
		ID-17050121-10	
		ID-17050121-12	
		ID-17050121-16	
		ID-17050121-18	
None Available	704.00	ID-17050121-02	Anderson Creek
	708.00	ID-17050121-17	Bull Creek
	None Available	ID-17050121-05	Lightning Creek
		ID-17050121-07	Big Bulldog Creek
		ID-17050121-08	
		ID-17050121-09	Bulldog Creek
		ID-17050121-11	Rattlesnake Creek
		ID-17050121-13	Silver Creek
		ID-17050121-15	
		ID-17050121-14	Peace Creek
		ID-17050121-19	Scriver Creek
		ID-17050121-20	
		ID-17050121-21	Middle Fork Scriver Creek

*Based on Fourth Field Hydrologic Unit Code.

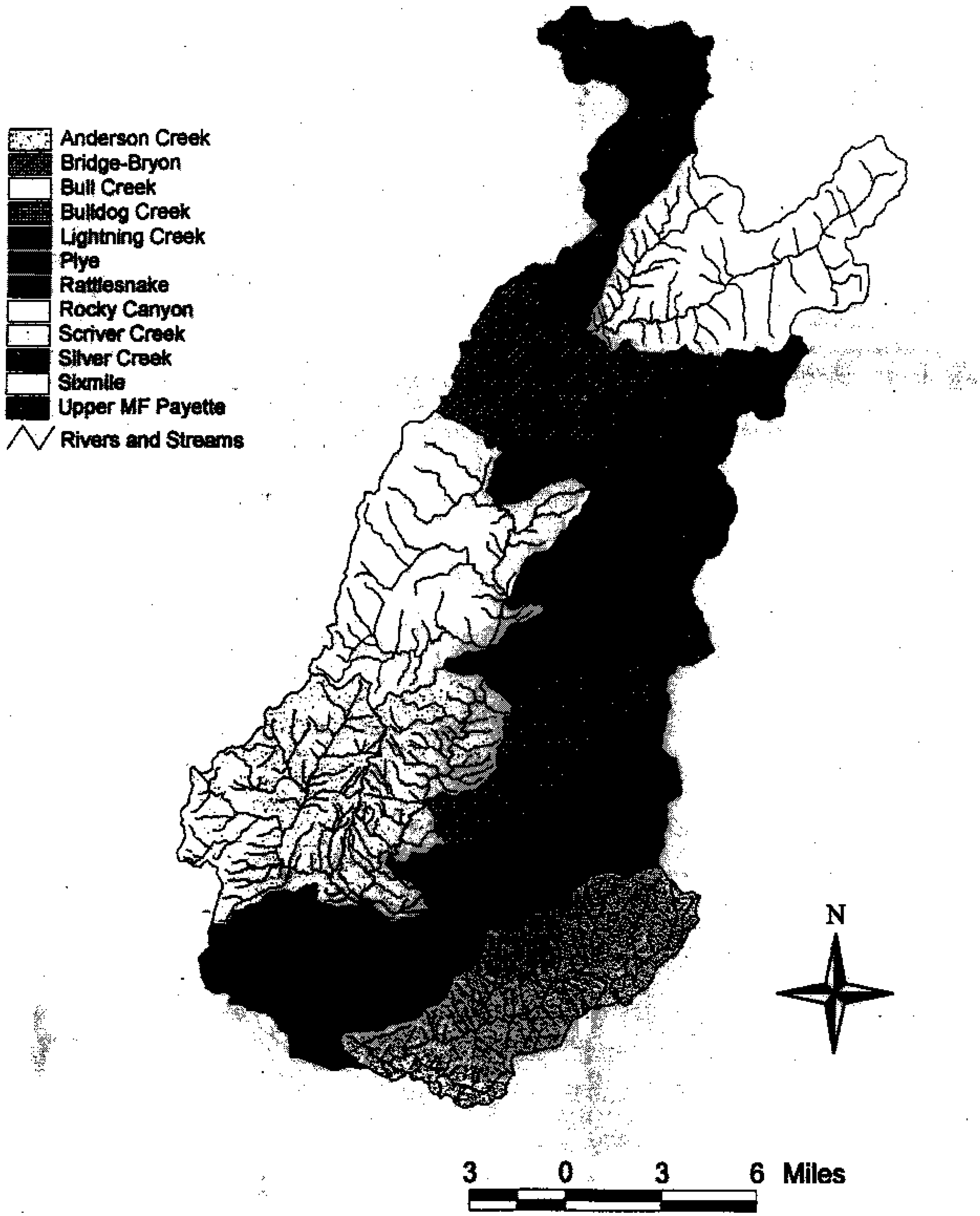


Figure 2: Sixth Field Hydrologic Unit Sub-Watersheds

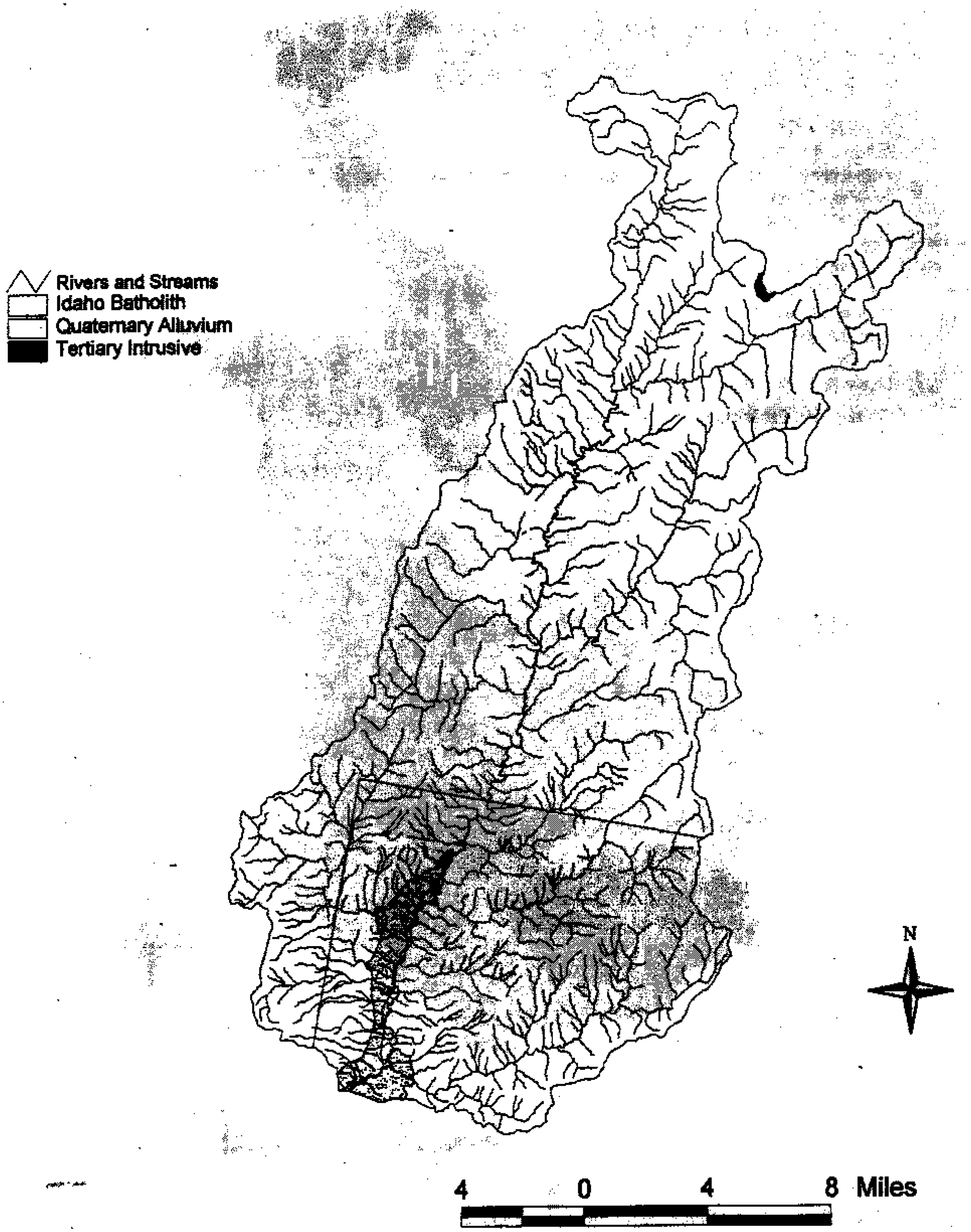


Figure 3: Geology of Middle Fork Payette River Basin

The steep, dissected mountainous lands of quartz monzonite and granodiorite have slopes ranging from 20 to 65 percent (Figure 4). The primary geomorphic processes that have shaped the landscape include faulting, fluvial actions, frost churning, and glaciation. Faulting appears to have been a major influence as the sub-basin follows a north-east trending normal fault. This is presumably of Eocene age and represents a zone of crustal extension during emplacement of the batholith. Uplifted blocks provide topographic relief to the eroded ridges and depositional valley landforms. In the lower portions of the sub-basin, broad valley bottoms were created as alluvial material accumulated behind fault blocks that obstructed major streams. The canyons were formed after streams became deeply incised and breached the fault blocks. There is an up-warp at the northern boundary of the faulting, which resulted in the asymmetrical basins of the principle streams in this part of the batholith. It enabled headwater streams south of the up-warp to extend in a northern direction. The entrenchment of the Middle Fork Payette River near Railroad Pass gives some evidence that lands at the present sub-basin divide may have drained into the headwaters of the South Fork Salmon River.

Valley glaciation during the Pleistocene Era is indicative of the U-shaped valleys in Lightning Creek, Silver Creek, and Bull Creek drainages. The only remnant deposits, which may be attributed to glaciers, are in small areas at the head of Sixteen-to-one Creek and the main stem of the Middle Fork Payette River.

2.1.1.4. Vegetation

The sub-basin is dominated by steep to moderately steep mountainous terrain covered by coniferous forests. About two percent of the sub-basin is relatively flat and is generally located in the lower elevations. These flats are mostly pasture lands.

Vegetation communities are strongly influenced by climate, landform, and geology. The lower elevation flat and benched areas along the lower Middle Fork Payette River are composed of pasture grasses, bunch grass, sage brush, and bitter brush with scattered clumps of ponderosa pine (USDA, 1976). Ponderosa pine is the principle tree species in the lower elevation areas mixing with Douglas-fir and grand fir at mid elevations and on north-facing slopes. Sub-alpine fir dominates the higher elevation areas, above 2133 meters (7000 ft), with Douglas-fir, lodgepole pine, and white bark pine present. Lodgepole pine is found in nearly pure stands scattered throughout the mid to higher elevation areas, particularly in flat cold air drainage pockets and where fire disturbance has occurred in the grand fir vegetation communities. Subalpine fir, spruce, and lodgepole pine are found along drainage ways.

2.1.1.5. Aquatic Fauna

Anadromous fishes historically occurred in the Middle Fork Payette River. These most likely included pacific lamprey (*Entosphenus tridentatus*), Snake River "spring" and "summer" chinook salmon (*Oncorhynchus tshawytscha*), and steelhead trout (*Oncorhynchus mykiss*) (Lee et al., 1996). The Black Canyon Dam effectively blocked migration of these fishes in 1924.

Resident fishes, as far as it is known, including suckers (*Catostomidae*), sculpins (*Cottidae*), mountain whitefish (*Prosopium williamsoni*), interior (Columbia River) redband trout (*Oncorhynchus mykiss*), bull trout (*Salvelinus confluentus*), hatchery stocks of rainbow trout (*Oncorynchus mykiss*), and brook trout (*Salvelinus fontinalis*), are found in the Middle Fork Payette River sub-basin (Boise National Forest, 1995; Lee et al., 1996). Simpson and Wallace (1982) reported bridgelip suckers (*Catostomus columbianus*) collected at the confluence of the Middle Fork and South Fork of the Payette rivers. They were also observed in Anderson Creek (Boise National Forest, 1995). Rainbow trout and brook trout

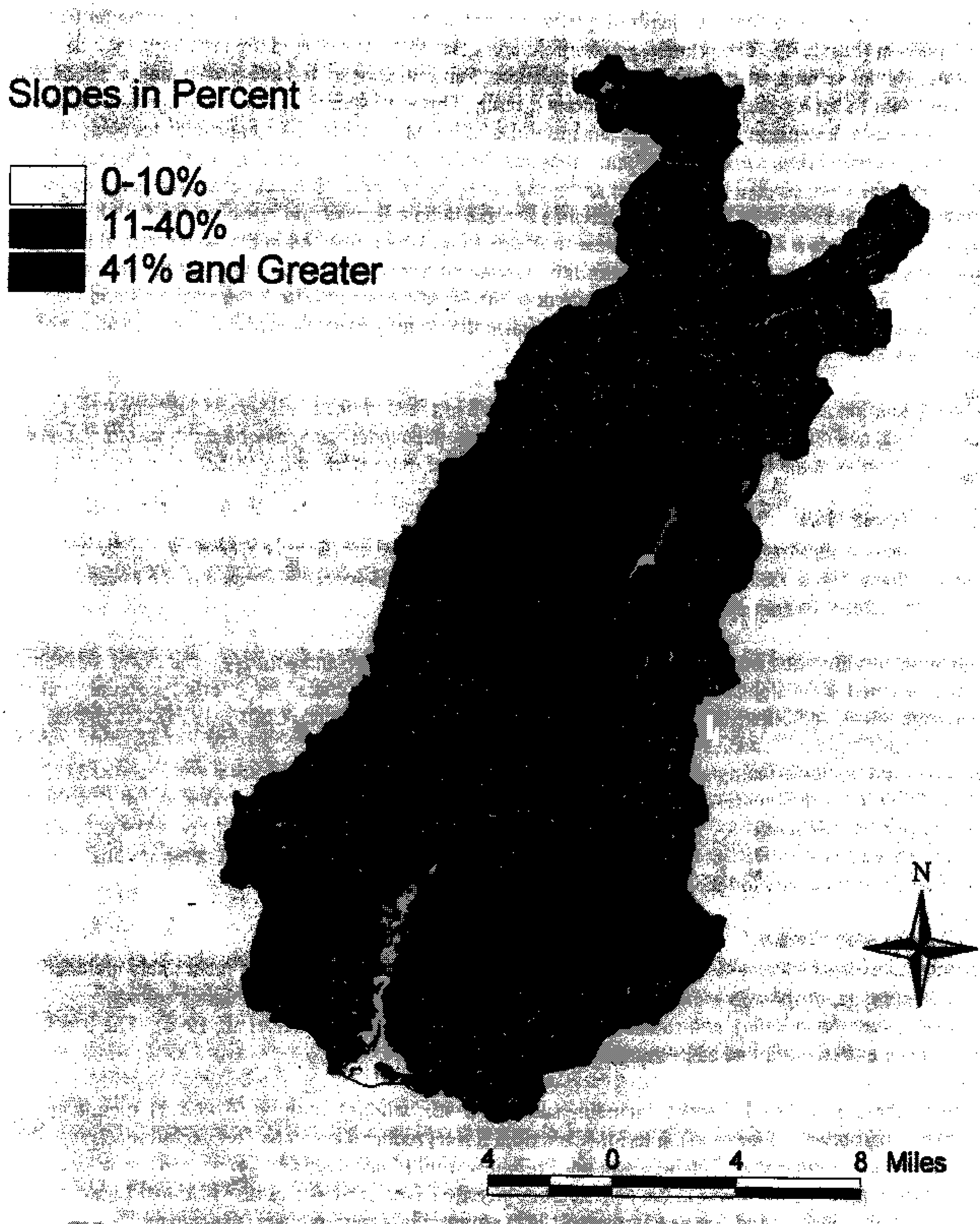


Figure 4: Slope Map of the Middle Fork Payette River Basin

have been introduced (Lee et al., 1996). Native interior redband trout and introduced rainbow trout are the most widespread and abundant resident species (Boise National Forest, 1995). Interior redband trout numbers are depressed throughout most of the Middle Fork Payette River sub-basin and predicted to be strong in Bull Creek waters (Lee et al., 1996). Bull trout have been observed in Bull Creek, and throughout the Middle Fork Payette River, and haven't been detected in Bulldog Creek, Sixmile Creek, Silver Creek. Strength status has not been predicted. Bull trout spawning is unlikely to occur below 1500 meters (4920 ft) elevation or in watersheds smaller than 400 ha (990 acres) in size (Rieman et al., 1995). Bull trout spawning and rearing is unlikely in most of the watershed. Upper portions of Bull Creek and Upper Middle Fork Payette are the only segments currently being used for bull trout spawning and rearing. Other segments with potential but no utilization by bull trout include: upper Lightning Creek, Peace Creek, upper Silver Creek, lower Bull Creek, lower Upper Middle Fork Payette, and upper portions of Six Mile Creek.

Many of the Middle Fork Payette River sub-basin fish are of concern because of their reduced numbers. Those fish whose major recovery obstacles can be attributed to the loss of anadromy include the pacific lamprey, a state endangered species (Idaho Department of Fish and Game, 1994), and the Snake River "spring" and "summer" chinook salmon, and steelhead trout that are listed as threatened under the federal Endangered Species Act. On the other hand, there are fish whose recovery obstacles include pollutant reduction, such as this TMDL provides. Bull trout were listed as threatened by the US Fish and Wildlife Service spring of 1998. The State of Idaho has identified the Middle Fork Payette River watershed as a bull trout key watershed (State of Idaho, 1996). Interior redband trout are a federal candidate species and a state Species of Special Concern.

Data collected in the Middle Fork Payette River sub-basin relevant to fish mostly address summer distribution and abundance, and available habitat. Interior redband trout and rainbow trout are spring spawners (Simpson and Wallace, 1982). Bull trout, brook trout, and mountain whitefish are fall spawners. Bull trout likely exhibit fluvial and residential life history forms in the Middle Fork Payette River sub-basin, spawning and rearing in tributary streams for a variable number of years before moving to larger streams and rivers to mature. They have more specific habitat requirements than other salmonids. Bull trout require clean substrate, stable channels, cold water temperatures, cover, and migratory corridors (Rieman and McIntyre, 1993). The relation to factors limiting bull trout and other fish is presented in Appendix A.

Most of the fishery information collected in this watershed are from the upland tributaries. Since the lower section of the Middle Fork of the Payette has relatively low numbers of fish, is not administered by Boise National Forest (who does most inventories in the area) it has not been intensively monitored.

In 1978, Lyle Burmeister and Don Corley, fishery biologists for the Boise National Forest, evaluated the Middle Fork Payette River. Their primary conclusion was that the lack of quality pools was limiting cold water fish species (Burmeister, 1978).

2.1.1.6. Sub-watershed and Stream Characteristics

The valley cross sections within tributaries to the Middle Fork Payette are deep, V-shaped in the mountainous upper elevation, shallow and rounded at mid-elevations, and become very wide within the lower valley of the Middle Fork Payette near Crouch. The stream channel varies from Rosgen "B" type in the upper watershed to a "C" type in the lower watershed. The "B" channels are generally transport reaches and are dominated by particles of a bimodal distribution. Many particles are of boulder and large cobble sized, the second group is primarily sand sized or smaller sized particles. The "C" channels are generally deposition reaches and are dominated by sand sized or smaller sized particles.

Table 3: Summary of Sub-watershed Characteristics*

Pure Subwatersheds	drainage area (square miles)	total stream length (miles)	drainage density	depositional reach density	minimum elevation (feet)	maximum elevation (feet)	basin length (miles)	relief ratio	Measured bankfull discharge (cfs)	Predicted bankfull discharge (cfs)
Upper MF Payette	24.8	46.2	1.86	0.562	4379	6800	11	0.042		110
Bull	37.9	67.9	1.79	0.334	4379	8080	12.8	0.055		189
Sixmile	14.6	27.6	1.89	0.502	3680	6000	6.2	0.065	37	56
West Fork	10.9	16.7	1.53	0.620	3800	6128	6.8	0.065		38
Wet Foot	10.6	12.6	1.19	0.394	4000	6480	5	0.094	31.7	37
Silver	40.0	73.0	1.83	0.407	3740	7960	15.4	0.052	205.6	203
Rattlesnake	11.0	17.2	1.57	0.485	3520	6760	6	0.102	49.9	39
Bulldog	15.9	37.2	2.35	0.249	3120	7640	10.2	0.084	86.7	62
Lightning	25.8	58.5	2.27	0.344	3060	7920	11.6	0.079	164.0	116
Scriver	29.8	82.3	2.76	0.463	3050	6400	8.4	0.076	102.9	139
Anderson	35.2	94.7	2.69	0.370	3020	7800	14.6	0.062	150.1	172
Composite Subwatersheds	**drainage area (square miles)**	**total stream length (miles)**	**drainage density**	**depositional reach density**	**minimum elevation (feet)**	**maximum elevation (feet)**	**basin length (miles)**	**relief ratio**	**Measured discharge (cfs)**	**Predicted bankfull discharge (cfs)**
Groundhog	14.6	34.7	2.37	0.570	4160	7748	4.4	0.154		56
Lake	6.7	13.5	2.02	0.320	4220	6889	3.6	0.140		21
Bridge	9.1	12.8	1.41	0.532	4020	6400	4.4	0.102		30
Rocky Canyon	21.4	54.3	2.54	0.712	3050	5700	2	0.251		91
Pyle	30.5	93.4	3.06	1.046	3000	5800	6.2	0.086		144

*(Fitzgerald et al., 1998a)

2.1.2. Cultural Characteristics

The Middle Fork Payette River basin is located in Valley and Boise counties. About 97% of the basin is managed for timber production by the USDA Boise National Forest, the State of Idaho Department of Lands, and the Boise Cascade Corporation (Figure 5). The remaining 3% is composed of the town of Crouch and small agriculture operations, and recreational homes.

Within Valley County the land ownership is almost exclusively National Forest land. The land ownership within Boise County are Boise National Forest (primary), State of Idaho, Boise Cascade Corporation, rural subdivisions, small agriculture operations, ranches, and the city of Crouch. Both counties have very low population densities. The Valley County portion of the Middle Fork Payette sub-basin is located in the headwaters and has no domestic residences. For comparison though, Valley County has a density of 1.6 people per square mile and Boise County has 1.8 people per square mile. These low population densities reflect the large amount of federal and state land. Both counties have experienced a high percentage of population growth when compared to other counties in Idaho, nearly three times the state average (McGinnis, 1996). This equates to about a 250 people per year increase in Boise County and a 400 people per year increase in Valley County.

A major road extends up the Middle Fork Payette River to Boiling Springs, a popular hot springs, with other roads extending up tributaries such as Anderson Creek, Scriver Creek, Lightning Creek, Sixmile Creek, West Fork Creek, and Silver Creek. A hot spring resort is located along Silver Creek and there are numerous undeveloped hot springs north of Boiling Springs. The city of Crouch is the main urbanized area within the sub-basin, however, there are also several rural subdivisions (summer and year-around residences) located along the lower river and its tributaries. The largest subdivision is Terrace Lakes located on benches along Warm Springs Creek.

Agriculture is conducted on a limited basis within the Middle Fork Payette basin. Pasture is present within the flatter side drainages around Crouch and hay is grown along the very flat portions closer to the Middle Fork Payette River. These activities are exclusively located within the Pyle sub-watershed near Crouch.

2.1.2.1. Land Use and Ownership

2.1.2.1.1 Forestry

Recent disturbance activities associated with timber harvesting within the Middle Fork Payette Sub-basin include wildfire and road construction. There have been four wildfires larger than 809 ha (2000 acres) and numerous small fires, generally less than one acre, since the mid 1980s. Wildfire activity has been most evident in the Anderson Creek, Sixmile Creek (West Fork Creek), Lake Creek, Scriver Creek, and Pyle Creek sub-watersheds. Timber harvest activities, along with wildfire events, have produced a mosaic of successional stages. Road densities vary according to management activity throughout the sub-basin. Maximum road densities can exceed 1.7 miles per square mile (e.g., Scriver Creek and Sixmile Creek sub-watersheds). The condition of the majority of the roads in the sub-basin is unknown at this time.

Not all areas within the sub-basin have been disturbed by timber harvest and associated activities. Some areas have had little or no harvest activities (e.g., Bull Creek and Rattelsnake Creek). Currently, stand densities within undisturbed areas generally exceed conditions subject to more frequent wildfire events (Malany, 1998).

Many of the riparian areas show disturbance from timber harvest, road construction, grazing, and dispersed recreation camping. Many of the primary access roads were built within or adjacent to the Middle Fork Payette River and tributary riparian areas. Figure 6 shows the current road density within the sub-watershed.

Roads that were originally built for forest products extraction have become the road system for many housing subdivisions within the areas adjacent to Crouch. Outside of the Crouch area these same roads are now used for snowmobiles, hunting, and other recreational uses. Because these roads were originally designed for seasonal use only they do not contain rolling dips, outsloped drainage control, or other sediment control measures normally present on roads intended for year-round use.

2.1.2.1.2. Agriculture/Grazing

Cattle, sheep, horse, and domestic elk grazing occur within the Pyle sub-watershed and within the lower portions of Lightning and Easley Creek. Cattle grazing is concentrated in the lower elevations and sheep grazing generally at the mid to high elevations. Pasture lands are primarily irrigated by gravity flow. Major water diversions for irrigation occur on Anderson Creek, Lightning Creek, Easley Creek, and the

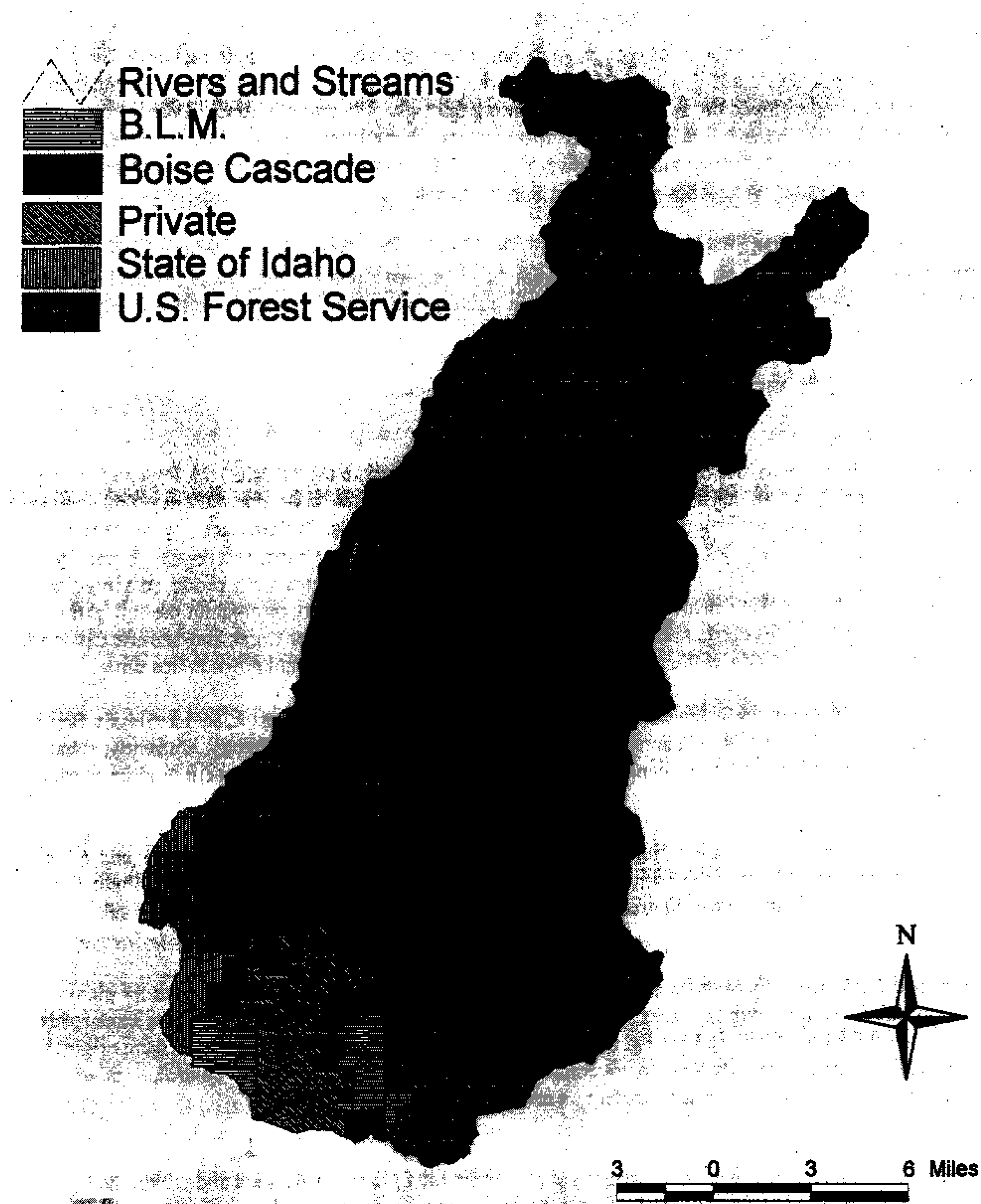


Figure 5: Land Ownership Within the Middle Fork Payette River Basin

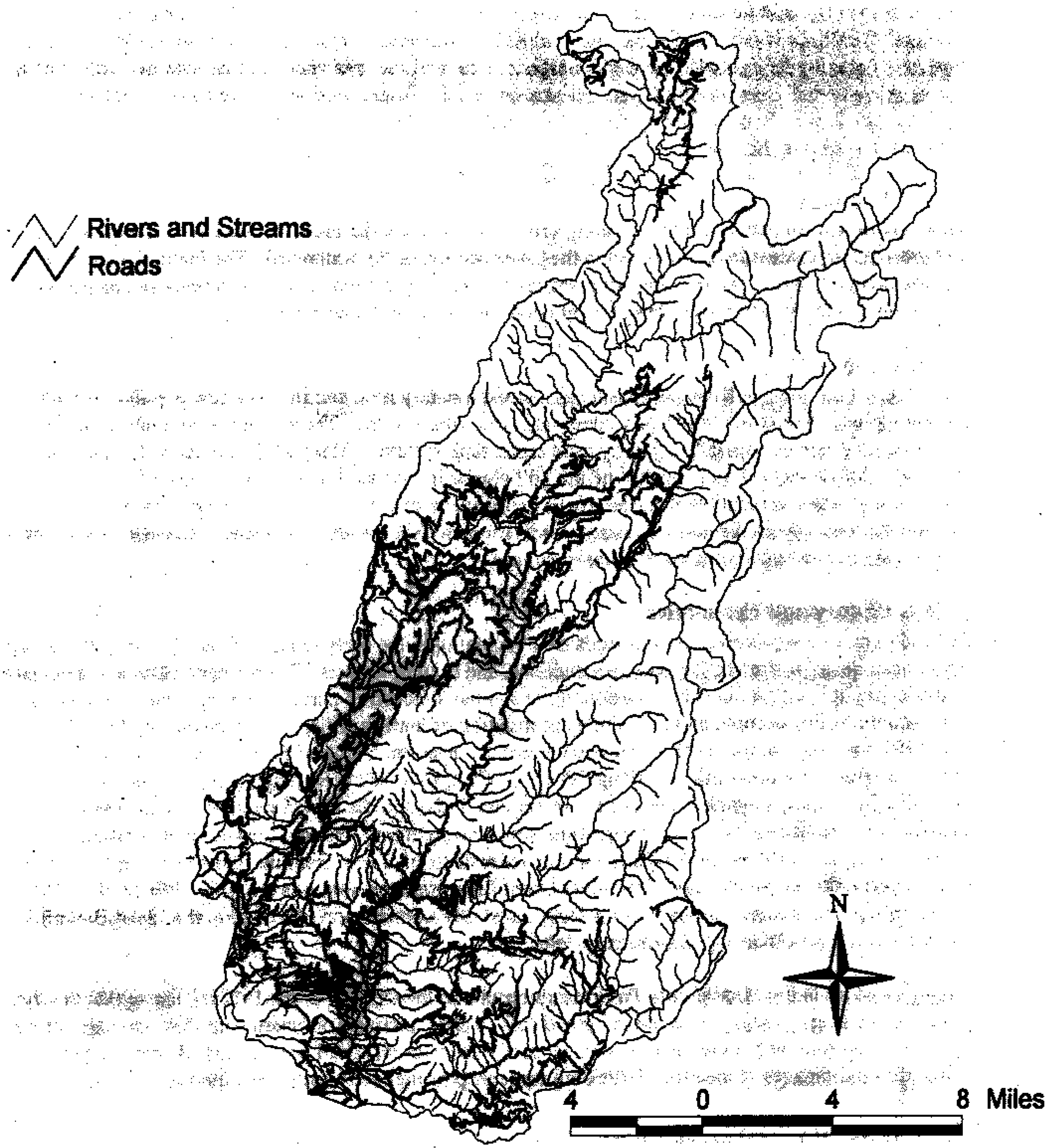


Figure 6: Road Density Within the Middle Fork Payette River Basin

main stem of the Middle Fork Payette River. Other areas are irrigated by sprinklers or depend on precipitation (dry land farming). Hay is the typical crop within this area with two cuttings per year on the average. No tillage is required for this crop unless a modification of the hay variety or quality is desired. Past cattle grazing far exceeded current conditions. Much of the area once used for intense cattle grazing has been converted to pasture for horse. Horses are usually fenced well above the banks of the Middle Fork Payette River. Bank trampling along the Middle Fork Payette River is evident in those areas where cattle have access to the river.

2.1.2.1.3. Mining

There are no known precious metals mining activities in the Middle Fork Payette River sub-basin. Past and present aggregate mining is limited to the lower section of the watershed. The Idaho Division of Environmental Quality has restricted all point source discharges from existing and proposed aggregate operations in the basin to eliminate sediment contributions from these operations.

2.1.2.1.4. Urban

The Middle Fork Payette River sub-basin has a predominately rural setting. The few population centers present include the city of Crouch and numerous rural subdivisions. The businesses and homes in Crouch and other areas are on separate or jointly used septic tank systems. Many of the homes in Crouch and in the rural subdivisions maintain lawns and the golf course in Terrace Lakes also has vast areas of manicured landscaping. Also, as mentioned earlier, roads that were originally built for forest products extraction have become the road system for many housing subdivisions within the areas adjacent to Crouch. These roads may or may not be re-constructed for year round use.

2.1.2.2. History and Economies

Early settlers used wood products from this area beginning in the early to mid 1800s. The majority of uses would have been for firewood, home constructions, and mining timbers. Timber harvesting and associated road construction within the valley portion of the sub-basin occurred during the early 1900s. A second entry into the valley portion, along with the construction of lumber mills, took place during the 1950s. Up until 1950, the main Middle Fork Payette road went as far as the mouth of Silver Creek, with connecting roads over Trail Creek Summit and along Silver and Bridge Creeks to Boiling Springs. From the 1950s on, timber harvesting and associated road construction in the Middle Fork Payette River sub-basin expanded into tributaries such as Scriver, Anderson, and Lightning Creeks. This activity continued to increase through the 1960s and 1970s as the sub-watersheds of Silver, Sixmile, West Fork, and Wet Foot were managed for timber harvest. The Silver Creek Experimental Area was set up in 1961 by the USDA Forest Service to research various impacts from forest management activities within the Idaho Batholith (Payette River Local Working Committee, 1990).

Grazing pressure in the Middle Fork Payette sub-basin was heavy prior to the 1970s. During these early periods heavy sheep grazing occurred in upland area. Cattle grazing associated with the local agriculture population occurred within the lower valley portion of the sub-basin and within Little Anderson and Scriver Creek drainages. Since the 1970s both types of grazing have steadily declined.

2.2. Regulatory Requirements

In 1994 EPA placed five tributaries and the mainstem of the Middle Fork Payette River on Idaho's §303(d) list as water quality limited due to excess sediment. These segments were carried forward to the 1996 list. The listed segments included: Anderson Creek, Lightning Creek, Scriver Creek, Bulldog Creek, Silver

Creek, and the mainstem of the Middel Fork Payette River. All of these segments were located within the Boise National Forest and were determined to be water quality limited based on exceedences of the Boise National Forest Plan standards and guidelines (USDA, 1990) and best professional judgement. Guidance for listing water bodies as water quality limited provided by Region 10 of the EPA states that any determination of water quality limited status based on this type of exceedences and professional judgement can be re-examined (EPA, 1995).

The listed water quality limited segments within the Middle Fork Payette sub-basin were re-analyzed according to current Idaho water quality standards and the IDEQ Water Body Assessment Guidance (IDHW, 1996a) as specified under IDAPA 16.01.02.053 during the preparation of this TMDL. The IDEQ Water Body Assessment Guidance requires the use of the most complete data available to make beneficial use support status determinations.

Results of the Water Body Assessment for the Middle Fork Payette River indicate that the lower reaches (i.e., below Big Bulldog Creek) are not fully supporting cold water biota due to a high sediment load and subsequent changes to channel morphology. The narrative Idaho water quality standard for sediment states that "sediment shall not exceed quantities...which impair designated beneficial uses" (IDAPA 16.01.02.200.08). These lower reaches, therefore, are currently considered to be water quality limited based on the Idaho narrative water quality standard for sediment.

Additional Water Body Assessments conducted for tributaries to, and the upper segments of, the Middle Fork Payette River found that designated and existing beneficial uses are currently at full support (Appendix A). These segments, originally on the 1994 §303(d) list, have been dropped from the State of Idaho's 1998 §303(d) list. The 1998 §303(d) list has not been submitted at the time of this report. However, the pollutant load allocations within this TMDL reflect the current IDEQ support status based on the Water Body Assessments for the mainstem and the tributaries to the Middle Fork Payette River.

2.2.1. Federal Requirements

The Federal Clean Water Act (CWA) requires restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters (Public Law 92-500 Federal Water Pollution Control Act Amendments of 1972). Each state is required to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the water whenever attainable.

Section 303(d) of the Clean Water Act establishes requirements for states to identify and prioritize water bodies that do not meet state water quality standards despite the application of technology based controls on point sources. States must publish a list [a.k.a. §303(d) list] of these waters, including priority ranking of such waters, every two years. States must develop Total Maximum Daily Loads (TMDLs) set at a level to achieve water quality standards including seasonal variations and a margin of safety for waters identified on the §303(d) list. A TMDL documents the current load, the load capacity (i.e., the amount of a pollutant a water body can assimilate without violating a state's water quality standards), and allocates the load capacity to known point and nonpoint sources.

TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint sources, including a margin of safety and natural background conditions. Regulations implementing §303(d) are found at 40 CFR Part 130. Total maximum daily loads are defined under §130.2 as:

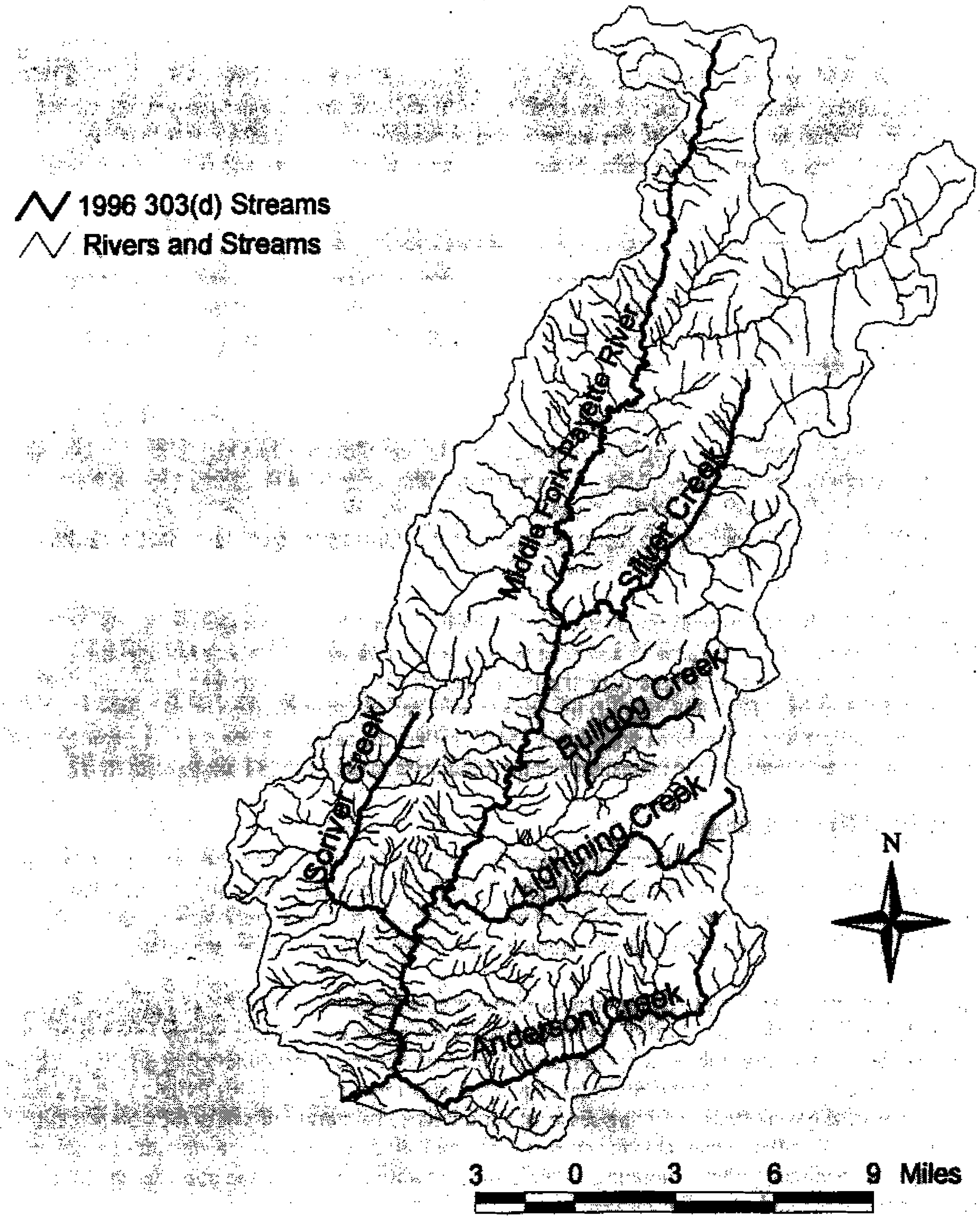


Figure 7: Water Quality Limited Segments Within the Middle Fork Payette River Basin[1]

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[1]Based on the 1994 §303(d) List

> *The sum of the individual WLAs for point sources and LAs for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure...*

In essence, TMDLs and TMDL Implementation Plans are water quality management plans which allocate responsibility for pollution reduction with a goal of achieving water quality standards within a specified period of time.

2.2.2. State Requirements

In response to a federal lawsuit in 1993, Idaho adopted Idaho Code sections 39-3601 through 39-3616, which establish state water quality law. In summary, these laws require:

- monitoring of all streams to establish designated uses and determine whether water bodies comply with state water quality standards;
- develop TMDLs for waters which do not comply with water quality standards; and
- establish citizen advisory groups [Basin Advisory Groups (BAGs) and Watershed Advisory Groups (WAGs)], to advise IDEQ on prioritizing impaired water bodies, how to properly manage impaired watersheds, and recommend pollution control activities in impaired watersheds.

Subsequent to adoption of Idaho Code §39-3601, et. seq., IDEQ adopted implementing regulations. Public participation requirements for BAGs and IDEQ are outlined in IDAPA 16.01.02.052. Idaho Administrative Procedures Act 16.01.02.053 establishes a procedure to determine whether a water body fully supports designated and existing beneficial uses, relying heavily upon aquatic habitat and biological parameters, as outlined in the Water Body Assessment Guidance (IDHW 1996a). Idaho Administrative Procedures Act 16.01.02.054 outlines procedures for identifying water quality-limited (WQL) waters that require TMDL development, publishing lists of WQL water bodies, prioritizing water bodies for TMDL development, and establishes management restrictions, which apply to WQL water bodies until TMDLs are developed.

2.2.3. Current Idaho TMDL Development Schedule

Pursuant to federal district court order, in 1996, the U.S. Environmental Protection Agency (EPA) issued a §303(d) list for Idaho, which identified 962 water bodies requiring TMDLs. The EPA and the IDEQ also submitted a schedule to the court for developing all required TMDLs on the 1996 §303(d) list within eight years. In the schedule, WQL water bodies are grouped by sub-basin, such that all TMDLs within the sub-basin will be developed at the same time. The TMDL development process is divided in three parts; 1) development of a sub-basin assessment; 2) development of water quality targets, loading estimates, assimilative capacity, and allocations; and 3) development of an implementation plan. Steps 1 and 2 are considered to be the TMDL required for EPA submittal and approval under the eight year development schedule. Step 3, the implementation plan, is to be developed within 18 months of EPA approval of Steps 1 and 2.

2.2.4. Applicable Water Quality Standards

Idaho has developed water quality standards to protect its waters. Idaho's water quality standards include;

surface water classifications for the designated beneficial use designations for surface waters (Section 2.2.4.1) and water quality criteria (Section 2.2.4.2).

2.2.4.1. Designated Beneficial Uses

Beneficial uses for many water bodies are listed in Idaho's Water Quality Standards and Wastewater Treatment Requirements (IDHW 1996b). The Middle Fork Payette River, source to mouth, have the following designated beneficial uses: domestic water supply, agriculture water supply, cold water biota, salmonid spawning, primary and secondary contact recreation, and as a special resource water (IDAPA 16.01.02.140.01.ee). Designated beneficial uses for this and other water bodies in the Middle Fork Payette River basin are listed in Table 4. The remaining water bodies in the Middle Fork Payette River sub-basin do not have specific beneficial use designations in IDAPA 16.01.02. These water bodies are given the designations of existing uses, cold water biota, secondary contact recreation, and primary contact recreation when enough flow is present (i.e., 5 cfs or greater) (IDAPA 16.01.01.101.01). Existing beneficial uses are those uses that existed on or after November 28, 1975, the effective date of the Clean Water Act.

2.2.4.2. Surface Water Classifications

Surface water classifications are also referred to as beneficial uses. These classifications are intended to protect surface water. They are comprised of five categories; water supply, aquatic life, recreation, wildlife habitat, and aesthetics.

Water supply waters are those which are <u>suitable or intended to be made suitable</u> for:

- agricultural - crop irrigation and water for livestock;
- domestic - drinking water; and
- industrial - water for industrial purposes.

Aquatic life waters are those which are suitable or intended to be made suitable for the protection and maintenance of viable communities of aquatic organisms and populations of significant aquatic species as follows:

- cold water biota - optimal growing temperatures below 18°C (64°F);
- warm water biota - optimal growing temperatures above 18°C (64°F); and
- salmonid spawning - which provide or could provide habitat for active, self-propagating populations of salmonid fish.

Recreation waters are those which are suitable or intended to be made suitable for:

- primary contact recreation - prolonged and intimate contact by humans or for recreational activities where the ingestion of small quantities of water is likely to occur; and
- secondary contact recreation - recreational uses on or about the water and which are not included in the primary contact category.

Wildlife Habitats waters are those which are suitable or intended to be made suitable for wildlife habitats. Aesthetics are applied to all waters.

Table 4. Designated Beneficial Uses in the Middle Fork Payette River Basin

Major Tributary	Aquatic Life		Water Supply			Recreation		Wildlife Habitats	Aesthetics
	Cold Water Biota	Salmonid Spawning	Ag.	Dom.	Ind.	1°	2°		
Middle Fork Payette River	D	D	D	D	D*	D	D	D*	D*
Anderson Creek	D*	E	E		D*	D*		D*	D*
Lightning Creek	D*	E	E		D*	D*		D*	D*
Big Bulldog Creek (lower)	D*	E			D*	D*		D*	D*
Big Bulldog Creek (upper)	D*				D*	D*		D*	D*
Bulldog Creek	D*				D*	D*		D*	D*
Rattlesnake Creek	D*	E			D*	D*		D*	D*
Silver Creek (lower)	D*	E			D*	D*		D*	D*
Peace Creek	D*	E			D*			D*	D*
Silver Creek	D*	E			D*	D*		D*	D*
Bull Creek	D*	E			D*			D*	D*
Scriver Creek (lower)	D*	E			D*	D*		D*	D*
Scriver Creek (upper)	D*	E			D*	D*		D*	D*
Middle Fork Scriver Creek	D*	E			D*			D*	D*

D - "designated" in §140 of Idaho Water Quality Standards and Wastewater Treatment Requirements

D* - "default designation", identified as result of Beneficial Use Reconnaissance Project monitoring or observation through §100 or §101 of Idaho Water Quality Standards and Wastewater Treatment Requirements

E - existing use identified as result of Beneficial Use Reconnaissance Project monitoring data or observation.

2.2.4.3. Water Quality Criteria

Idaho water quality standards includes water quality criteria necessary to protect the beneficial uses. It is IDEQ's position that habitat characteristics which might adversely affect beneficial uses are not pollutants under §303(d) of the Clean Water Act. Therefore, none of the State of Idaho water quality criteria specify habitat requirements for beneficial use support.

Idaho water quality standards are broken into three sections; General Surface Water Criteria, Surface Water Quality Criteria for Use Classifications, and Site-Specific Surface Water Quality Criteria. For reference please refer to the Idaho Water Quality Standards and Wastewater Treatment Requirements (IDHW, 1996b).

2.2.4.3.1. General Surface Water Criteria

The general surface water criteria are usually referred to as the narrative criteria. These criteria are applied to all waters of the state in addition to other criteria that may apply. Generally, these criteria state that waters shall be free from materials or matter in concentrations that impair beneficial uses. Sediment is among these materials. Middle Fork Payette River water bodies are listed in §303(d) for impairment as a result of sediment. The general surface water criteria for sediment (IDAPA 16.01.02.200.08) from Idaho Water Quality Standards and Wastewater Treatment Requirements (IDHW, 1996b) is as follows:

> *Sediment shall not exceed quantities specified in Section 250, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.02.b.*

Section 250 specifies a numerical turbidity standard for cold water biota. This standard includes a maximum of 50 NTU above background at any time or a maximum of 25 NTU above background for 10 consecutive days. Subsection 350.02.b generally describes the Best Management Practices feedback loop for non-point source activities.

2.2.4.3.2. Surface Water Quality Criteria for Designated Use Classifications

These criteria are usually referred to as the "numeric criteria" and include specific concentrations for individual pollutants that are based on categories and individual beneficial uses.

Recreation

Primary contact recreation criteria apply during the summer months, and secondary contact recreation applies year round. The major constituent is fecal coliform bacteria. Those water bodies for which primary contact recreation is designated, existing, or not precluded from should have fecal coliform bacteria counts of less than 500/mL (17/oz) at any time or less than 200/mL (7/oz) averaged over a 30 day period. All other water bodies (secondary contact recreation) should have fecal coliform bacteria counts of less than 800/mL(27/oz) at any time or less than 400/mL (13.5/oz) over a 30 day period. Fecal coliform bacteria concentrations represent concentrations of materials that have passed through warm blooded animals intestines, and are also surrogates for other pathogens. There are also toxic substances criteria set forth in 40 CFR 131.36(b)(1) Column D2.

Aquatic Life

All streams with aquatic life use classifications (cold water biota, warm water biota, salmonid spawning) should have concentrations of:

- pH between 6.5 and 9.5;
- dissolved gas not exceeding 110%;
- total chlorine residual of less than 19 μg/L/hr or and average of 11 μg/L/4 day period;
- less than toxic substances criteria set forth in 40 CFR 131.36(b)(1) Columns B1, B2, D2.

Cold water biota are the life forms that inhabit cold water. These life forms include: game and non-game fish; aquatic macroinvertebrates; and aquatic periphyton. All streams with cold water biota use classifications should have concentrations of:

- dissolved oxygen concentrations exceeding 6.0 mg/L;
- temperatures less than 22°C (72°F)(instantaneous), and 19°C (66°F)(daily average);
- low ammonia (formula/tables for exact concentration);
- turbidity less than 50 nephelometric turbidity units (instantaneous) or 25 nephelometric turbidity units (10 day average) greater than background.

Salmonids are all those fish that are classified in the family Salmonidae. The family Salmonidae contains the whitefish, salmons, trouts, chars and graylings. Salmonids are characterized by the presence of an adipose fin and a pelvic appendage. Spawning criteria apply during time periods listed in Idaho Water Quality Standards and Wastewater Treatment Requirements, unless site specific spawning periods are available. The time periods are based on the spawning and egg incubation period by each species of salmonid. The most likely native salmonids to be spawning in in the Middle Fork Payette River sub-basin are redband and rainbow trout (January 15 - July 15), and bull trout (September 1 - April 1), and mountain whitefish (October 15 - March 15). Salmonid spawning numeric criteria would apply to Middle Fork Payette River sub-basin from September 1 to July 15, as a result of the cumulative needs of salmonids. All streams with salmonid spawning use classifications should have concentrations of:

- intergravel dissolved oxygen exceeding 5.0 mg/L (instantaneous) or 6.0 mg/L (7 d average);
- dissolved oxygen concentrations exceeding 6.0 mg/L (same as cold water biota);
- water temperatures less than 13°C (55°F)(instantaneous), 9°C (48°F)(daily average); or
- low ammonia (same as cold water biota).

Water Supply and Other Uses

Water supply use classifications include domestic drinking water, wildlife habitats, and aesthetics. The last two beneficial uses should generally be supported when more sensitive beneficial uses criteria (e.g., cold water biota) and general water quality criteria are applied.

The State of Idaho Department of Health and Welfare is the primary agency responsible for the protection of public drinking water in the State of Idaho. Idaho Rules for Public Drinking Water Systems include criteria necessary to protect all domestic water supplies. Requirements have been set forth for Treatment Techniques (IDAPA 10.01.08.500), Design Standards (IDAPA 10.01.08.550), and Operating Criteria for Public Drinking Water Systems (IDAPA 10.01.08.552).

Drinking water systems are classified according to whether a system is a public system and the number of people usually served. According to the IDEQ (Rae, 1998) there are two public water supply systems within the Middle Fork Payette Sub-basin. One is located just up from the confluence with the South Fork Payette River and serves the Rivers Point Subdivision. The other is located within the Scriver Creek sub-watershed, on Warms Springs Creek. No non-community (transient or non-transient) water systems within the sub-basin have been identified. All surface sources of drinking water must maintain filtration and disinfection systems intended to maintain safe drinking water (IDAPA 16.01.08.550.05).

2.3. Water Quality Concerns and Status

The Idaho Water Quality Standards designate the beneficial uses for the Middle Fork Payette River as salmonid spawning, cold water biota, secondary recreation, primary contact recreation, domestic water supply, agricultural water supply, and as a special resource water (IDAPA 16.01.02.140.01.ee). Tributaries to the Middle Fork Payette River without specific beneficial use designation in IDAPA 16.01.02 are given designations of existing uses, cold water biota, secondary contact recreation, and primary contact recreation when enough flow is present (i.e., 5 cfs or greater) (IDAPA 16.01.02.101.01). IDEQ Beneficial Use Reconnaissance Project (BURP) surveys have been conducted on numerous water bodies within the Middle Fork Payette River basin since 1995. These BURP data and other data were analyzed following the guidance provided in the IDEQ Water Body Assessment Guidance (IDHW 1996a). Available data for water body assessments within the Middle Fork Payette River basin are listed in Table 5. Current support status as determined by the IDEQ are listed in Table 6.

2.3.1. Sediment Source Inventory

The purpose of this pollutant source inventory is to assess the current sources of sediment in the Middle Fork Payette River. This assessment uses the IDEQ (1997) TMDL guidelines and is based on existing information on natural (i.e., background) and management related sediment sources within the Middle Fork Payette River basin. Currently, there are five land use categories in the watershed that must be considered as having the potential to increase sedimentation of the Middle Fork Payette River: 1) timber management; 2) dry land and irrigated agriculture; 3) grazing; 4) recreation; and 5) urban development.

2.3.1.1. General Background

Natural and management induced sediments sources in the Middle Fork Payette River have been studied by numerous individuals and agencies. The climatic, hydrologic, geologic, soils, vegetation and landform characteristics of this watershed are the cause of naturally high erosion rates (Reinig et al., 1991; Clayton, 1986; Megahan and Ketcheson, 1996; USDA, 1976). Historic and present land use have increased erosion rates and sediment yield, and caused excess sedimentation of the mainstem Middle Fork Payette River.

Sediment loads can be characterized by their frequency of delivery, particle size compositions, and amounts. For example, surface erosion from new road construction can deliver fine sediments to a stream on a frequent basis over a two to three year period. The high frequency of this delivery can combine with a large amount of available material when many roads are constructed at once, thus producing a large sediment load. Once a road has aged a few years, the frequency and amount of fine sediment delivery diminishes. Debris flows and other forms of mass wasting, on the other hand, can deliver a large amount of fine and coarse sediments to a stream during a single event. The remaining debris flow paths which remain after the event can produce surface erosion for a few years, much like a newly constructed road. Additional characteristics of debris flow deliveries are that they often occur during high stream flow events and occur less frequently than surface erosion sediment delivery events.

Once sediment has reached an active stream channel there are a variety of hydrologic processes that store or transport sediment down-stream. Sediment storage and transport are a function of sediment characteristics (e.g., input grain size distribution and fall velocity), channel energy dissipation (i.e., roughness), reach slope, and flow level. When the sediment input is increased within a stream system an overall decrease in the mean particle size or a widening and shallowing of the channel geometry occurs due to the change in the sediment transport capacity of a reach.

Field observations by IDEQ personnel have noted active streambank erosion in few isolated places within Reach 5 of the Middle Fork Payette River. The locations and amount of streambank erosion suggest that this erosion is a result of a high sediment load from the contributing area to Reach 5 and

Table 5. Available Data for the Middle Fork Payette River Hydrologic Unit

Source	Period of Record	Purpose of the Study with Monitoring Constituents	Used in SBA (Y/N)
Beneficial Use Reconnaissance Project	1993-present	To assess support status of designated and existing beneficial uses--chemical, physical, and biological measures.	Y
Burton, Timothy	1992	Evaluating the effectiveness of forestry best management practices using rapid bioassessment procedure: Silver Creek, BNF.	$N_{2,3}$
Boise National Forest Aquatic Survey Data Base	1993-1995	Compilation of fisheries and habitat data.	Y
Stream temperature: Silver Creek	1995	Characterize summer temperature regime for fish habitat-part of Silver Creek Landscape Assessment.	N_2
Stream channel cross-sections: West Fork Creek	1987	Forest Plan Trend Monitoring	N_1
Existing condition descriptions	1987-1994	Bear Wallow, Silver Creek Salvage, West Fork environmental assessments	N_2
Watershed-Fisheries Evaluation	1994	West Fork Environmental Assessment/Biological Evaluation	N_4
BOISED sediment model	1996	Sediment yield modeling of harvest activites, burning, and roads: Clear Creek Summit Environmental Assessment.	N_4
Temperature monitoring	1993, 1995	Assess support status of beneficial uses via temperature: Stoney Meadows, Ligget Creek, Middle Fork Payette River at 409 bridge.	N_2
R1-R4 Habitat Inventory	1993	Assess habitat for beneficial uses and presence/absence: Upper Middle Fork Payette River, Stoney Meadows Creek ((Wolman Pebble Count, snorkeling).	N_2
WFE Inventory	1994	Review of RCHA's and mitigation measures: Clear Creek Summit Environmental Assessment.	N_4
Biological Evaluation	1994	Evaluation of bull trout: Clear Creek Summit Environmental Assessment	N_4
Corley's fish and stream data	1994	Fish habitat data (bull trout presence/absence) and cobble embeddedness.	N_2
Burmeister, L. And D. Corley	1978	Stream inventory of the Middle Fork Payette River.	N_1

1. Data older than five (5) years.
2. Data not used in subbasin assessment, however, may be used in Total Maximum Daily Load.
3. Data not readily available.
4. Data does not apply to water quality-limited water body.

subsequent channel morphology change. The rate of erosion is a function of channel morphology change only. Therefore, it is thought that the percentage of the current sediment load due to bank erosion is not significant when compared to the sediment load from the contributing area to Reach 5.

Table 6. Support Status of Water Bodies withing Middle Fork Payette River Watershed

Water Body Identification	Description	Domestic Water Supply	Agri. Water Supply	Cold Water Biota	Salmonid Spawning	Primary Contact Rec.	Secondary Contact Rec.
ID-17050121-01	MF Payette - Anderson to mouth	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-02	Anderson Creek		Full Support	Full Support	Full Support	Full Support	
ID-17050121-03	MF Payette - Scriver to Anderson	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-04	MF Payette - Lightning to Scriver	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-05	Lightning Creek		Full Support	Full Support	Full Support	Full Support	
ID-17050121-06	MF Payette - Big Bulldog to Lightning	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-07	Big Bulldog - Bulldog to mouth			Full Support	Full Support	Full Support	
ID-17050121-08	Big Bulldog - headwaters to Bulldog			Full Support		Full Support	
ID-17050121-09	Bulldog Creek			Full Support		Full Support	
ID-17050121-10	MF Payette - Rattlesnake to Big Bulldog	Full Support	Full Support	Full Support	Full Support	Full Support	Full Support
ID-17050121-11	Rattlesnake Creek			Full Support	Not Assessed	Full Support	
ID-17050121-12	MF Payette - Silver to Rattlesnake	Full Support	Full Support	Full Support	Full Support	Full Support	Full Support
ID-17050121-13	Silver - Peace to mouth			Full Support	Full Support	Full Support	
ID-17050121-14	Peace Creek			Full Support	Full Support	Full Support	
ID-17050121-15	Silver - headwaters to Peace			Full Support	Full Support	Full Support	

Water Body Identification	Description	Domestic Water Supply	Agri. Water Supply	Cold Water Biota	Salmonid Spawning	Primary Contact Rec.	Secondary Contact Rec.
ID-17050121-16	MF Payette - Bull to Silver	Full Support	Full Support	Full Support	Full Support	Full Support	Full Support
ID-17050121-17	Bull Creek			Full Support	Full Support	Full Support	
ID-17050121-18	MF Payette - headwaters to Bull	Full Support	Full Support	Full Support	Full Support	Full Support	Full Support
ID-17050121-19	Scriver - MF Scriver to mouth			Full Support	Full Support	Full Support	
ID-17050121-20	Scriver - headwaters to MF Scriver			Full Support	Full Support	Full Support	
ID-17050121-21	MF Scriver Creek			Full Support	Full Support	Full Support	

2.3.1.2. Background Sediment Production

Natural hillslope erosion processes include hillslope creep, mass failure, and surface erosion. Acceleration of erosion rates prior to anthropogenic land use change likely occurred as a result of fire and episodic precipitation, snowmelt, and flood events. In the Middle Fork Payette River, natural sources of sediment that results from bank erosion and channel degradation appear to be low relative to hillslope erosion rates.

Land managers within the Middle Fork Payette subbasin have evaluated background and management related erosion rates through the use of models. Two of these include BoiSed (Reinig et al., 1991) and SedMod (Boise Cascade, 1998). Background erosion rates in BoiSed are based on erosion rates measured during a long term study within the Silver Creek drainage of the Middle Fork Payette basin. These background rates include sediment inputs from hillslope creep, landslides, and other erosion mechanisms present under natural forested conditions (Table 7).

Table 7: BoiSed Background Hillslope Sediment Production with Sediment Transport Coefficient

Pure Watersheds	Background Sediment * (tonnes/yr; tons/yr)	Potential Stream Power	Discharge Coefficient	Discharge Adjusted Potential Stream Power**	Deposition Ratio	Potential Sediment Transport Coefficient***	Amount Delivered (tonnes/yr; tons/yr)
Upper MF Payette	1205; 1328	0.078	0.092	0.007	0.562	0.013	16; 17
Bull Creek	977; 1077	0.098	0.158	0.015	0.334	0.046	45; 50
Bridge-Bryon	1230; 1356	0.236	0.033	0.008	0.477	0.016	20; 22
Sixmile	1852; 2041	0.112	0.040	0.005	0.553	0.008	15; 16
Silver Creek	985; 1086	0.095	0.169	0.016	0.407	0.039	38; 42
Rattlesnake	255; 281	0.160	0.032	0.005	0.485	0.011	2.8; 3.1
Rocky Canyon	529; 583	0.637	0.076	0.048	0.712	0.068	36; 40
Bulldog Creek	491; 541	0.197	0.052	0.010	0.249	0.041	20; 22
Lightning Creek	621; 685	0.180	0.096	0.017	0.344	0.050	31; 34
Pyle	383; 422	0.262	0.120	0.031	1.046	0.030	12; 13
Scriver Creek	831; 916	0.209	0.116	0.024	0.463	0.052	43; 48
Anderson Creek	1046; 1153	0.167	0.143	0.024	0.370	0.065	68; 75

* Based on BoiSed Background Sediment Rate Estimates

** Stream Power x Discharge Coefficient (Fitzgerald et al., 1998a)

*** Adjusted Stream Power/Deposition Ratio (Fitzgerald et al., 1998a)

2.3.1.3. Management Related Sediment Production

2.3.1.3.1. Hillslope Erosion

In the Middle Fork Payette River hill slope erosion above background typically results from forest roads and timber harvest activities. Land use related causes of increased erosion rates include: 1) timber harvest activities; 2) grazing; 2) dry land and irrigated agriculture; 3) urban and suburban development; and 4) recreation. Additional processes that increase instream sediment include: 1) hydrologic alteration; 2) cattle grazing; 3) stream-side irrigation; and 4) instream construction. It is difficult to estimate the impacts of past intense grazing to the riparian area or channel morphology. The lower Middle Fork Payette River channel is slightly entrenched and the water seldom accesses the flood plain. The cumulative effects of forest practice's changes in hydrography, accelerated sediment rates, and grazing's bank de-stabilization have modified the nature of the channel.

2.3.1.3.2. Fire

Forest fires, natural and human caused, also increase erosion rates. Both surface erosion and mass wasting are increased after high intensity wild fires. Many of the existing sediment sources in the watershed result from fire. For example, high mass wasting frequencies are attributed to high intensity forest fires ignited during 1986. Fire occurrence over the past 50 years is shown in Figure 8 (USDA, 1997).

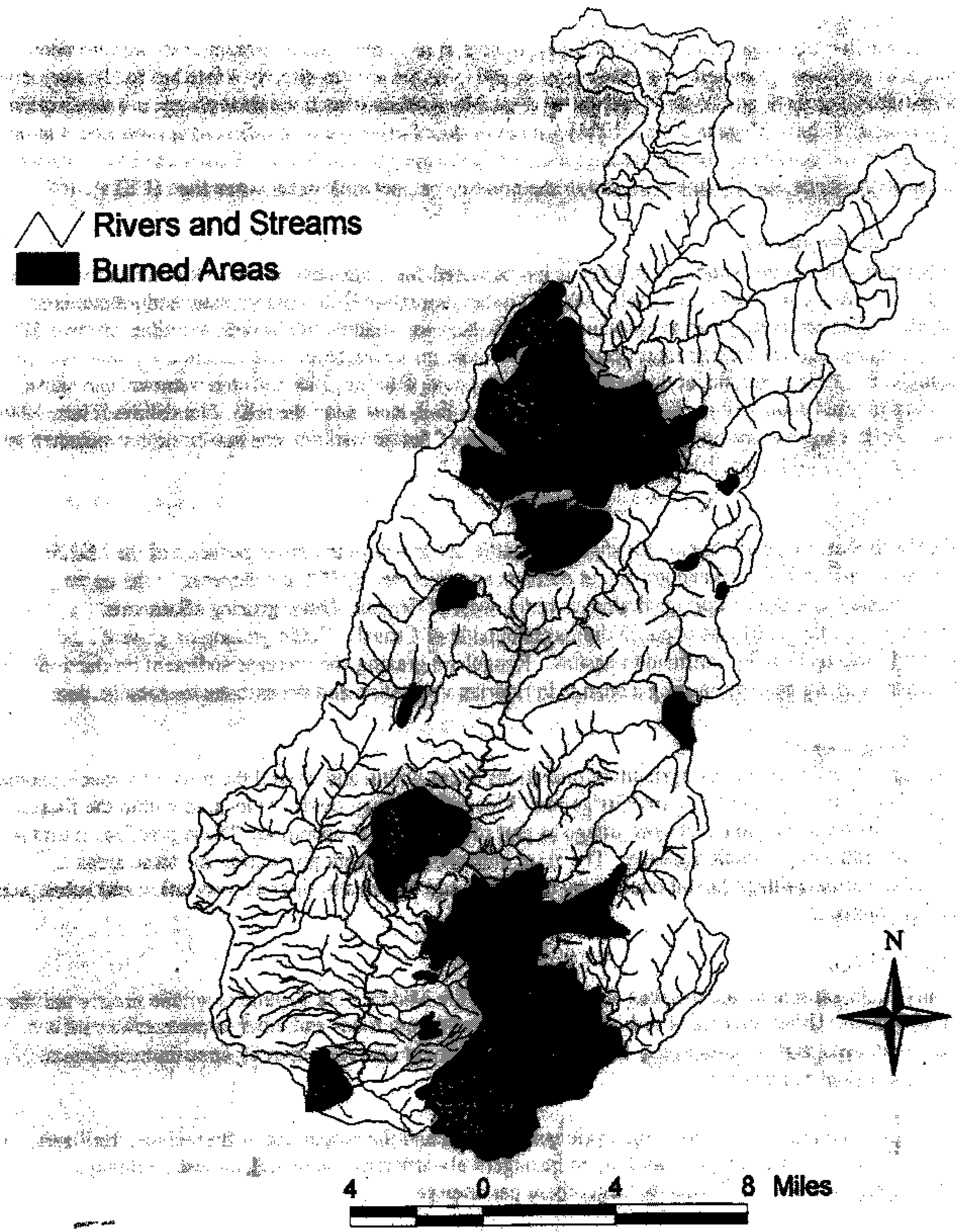

Figure 8: Fifty Year Fire Occurrence

2.3.1.3.3. Roads

Surface erosion from road cut slopes, fillslopes, tread surface, cross-drains, stream crossings are known sources of sediment. Accelerated surface erosion and mass failure are directly related to road construction and maintenance. In addition, slope instability caused by road construction and drainage problems often triggers mass failure (Megahan et al., 1978). In the Middle Fork Payette, the first roads were built in the early 1900s and continue to be the greatest source of anthropogenic sediment. Roads can have a variety of effects on the landscape. Figure 6 illustrates the present road network in the watershed (USDA, 1997).

2.3.1.3.4. Timber Harvest

Timber extraction in the Middle Fork Payette has occurred since the early 1900s. High intensity jammer logging occurred in the 1950s and early 1960s. Timber extraction from federal, state and private lands currently exists and is expected to continue. Disturbances associated with harvest activities are two fold. First, increased surface erosion rates occur during project implementation and continue for about six years (Reinig et al., 1991). Second, at the harvest unit scale, complete (i.e., clearcut) tree removal can cause increases in rapid snowmelt during rain-on-snow events thus increasing the risk of landslides (Harr, 1986; Luce, 1997). However, complete tree removal within the Middle Fork Payette sub-basin is conducted very infrequently if at all (Glass, 1998).

2.3.1.3.5. Range

Federal and State range allotments for sheep and cattle occur within the lower portions of the Middle Fork Payette River basin. Sheep grazing allotments administered by IDL are centered in the upper Scriver, Easley, and Warm Springs drainages to the west of Crouch. Other grazing allotments administered by the BLM also occur in drainages outside of Crouch. Cattle grazing on private land within this area tends to be confined to pasture. Rangeland grazing can increase sediment production within a stream drainage by causing a change in riparian vegetation and streambank destabalization.

2.3.1.3.6. Agriculture

Small scale, private alfalfa hay agriculture operations occur within and around the town of Crouch. Some of these agriculture operations involve irrigation. Most of these hay fields are located within the flattest portion of the basin and do not require tillage as part of their normal operation. These practices limit the amount of sediment production greatly. The main impacts to sediment production for these areas is confined to periodic tillage (about once every ten years) and changes to riparian vegetation and subsequent bank destablization.

2.3.1.3.7. Urban

The only sediment source due to urban activities within the Middle Fork Payette is within and around the town of Crouch. Urban sources of sediment include runoff from roads and other impermeable surfaces, unvegetated areas, and construction activities. These sediment sources generally contribute sediment during stormwater runoff events.

The effluent from properly functioning septic tank systems and the proper use of herbicides, fertilizers, and pesticides used in landscaping are unlikely to be negatively affecting the beneficial uses, although monitoring has not been performed to target these parameters.

Bank protection in order to protect adjacent property has negatively affected the beneficial use support of the Middle Fork Payette River. One of the actions a stream like the Middle Fork Payette River naturally performs, is meandering. As a stream meanders, fine sediment is deposited on point bars, and erosion occurs on the outside of meander bends. These meandering streams have much more of the complex habitat conditions the native fish are suited for, and more than is currently observed in the lower Middle Fork Payette River. A common practice for protecting ones property from eroding away is to armor (rip-rap, car bodies) the outside of the meander.

While there are many individuals in the community that have worked hard to prevent excess sediment from entering the Middle Fork Payette, a significant portion still do not see sediment input into the stream a problem. In the past and today, for individuals who haven't adopted stream improvement goals, the Middle Fork Payette River is and has been over utilized. Banks have been and still are damaged by recreational vehicles. Riparian vegetation has been and is still being removed for the view. Direct pollution also occurs. Individuals have been observed dumping wheel barrows of soil and other waste directly in the stream.

Both Valley and Boise Counties have experienced high population growth rates over the past few years (McGinnis, 1996). Around the Garden Valley area, which includes the town of Crouch, building permits within the Middle Fork Payette River Basin increased from 19 in 1990, to 104 in 1994, and dropping slightly to 54 and 78 in 1996 and 1997. Of the permits issued in 1997 approximately 38% were for new homes. Currently, no erosion control control or drainage control ordinances are in operation within this area (Boise County Planning Department, 1998).

2.3.1.4. Current Sediment Load Estimate

Estimates for hillslope sediment levels due to management activities and the increase over background due to management related activities can be made using a variety of models. Two of these include the draft SedMod (Boise Cascade, 1998) and BoiSed (Reining, el al, 1991). Neither of these two examine the effects of management activities on landslides, or incorporate increases to sediment loads due to fire, range, agriculture, or urban activities. Also, the estimates provided by these models are based on current sediment sources during average climatic conditions and, therefore, do not provide estimates of the current load being routed by the stream. The current sediment load estimates for both SedMod and BoiSed are presented in Tables 8 and 9.

Table 8: SedMod Percent Above Background*

Sub-Watershed	Management (tonnes/yr; tons/yr)	Background (tonnes/yr;tons/yr)	Percent Above Background (%)
Upper Payette	170.3; 187.7	240.9; 265.5	71
Bull	1.4; 1.5	357.3; 393.9	0.4
Bridge-Bryon	213.9; 235.8	398.0; 438.7	54
Silver	151.5; 167.0	387.3; 426.9	39
Sixmile	562.0; 619.5	385.4; 424.8	146
Rattlesnake	66.7; 73.5	98.6; 108.7	68
Rocky Canyon	342.8; 377.9	436.6; 481.3	79
Bulldog	0.0; 0.0	214.5; 236.4	0
Lightning	29.1; 32.1	334.9; 369.2	9
Scriver	446.2; 491.9	451.6; 497.8	99
Pyle	579.8; 639.1	550.6; 606.9	105
Anderson	303.7; 334.8	533.2; 587.8	57

*Based on road surface erosion (management) and hillslope creep (background) only. Landslide inputs are not considered in this estimate.

Table 9: SedMod Percent Above Background Results by Reach

Reach	Management (tonnes/yr)	Background (tonnes/yr)	Percent Above Background (%)	Cumulative Percent Above Background (%)
R1	278.7	797.2	35	35
R2	107	199	54	39
R3	713.7	772.7	92	62
R4	238.1	316.9	75	64
R5	200.5	767.7	26	54
R6	1026	1002.2	102	67
R7	303.7	533.2	57	65

Table 10: BoiSed Percent Above Background*

Sub-Watershed	Management (tonnes/yr; tons/yr)	Background (tonnes/yr; tons/yr)	BoiSed Percent Above Background (%)
Upper Payette	159.9; 176.3	823.8; 908.1	19.4
Bull	5.2; 5.7	706.4; 778.7	0.7
Bridge-Bryon	229.0; 252.4	1038.3; 1144.5	22.1
Silver	120.9; 133.3	1110.0; 1223.6	10.9
Sixmile	1044.7; 1151.6	1809.3; 1994.4	57.7
Rattlesnake	35.7; 39.3	344.7; 380.0	10.3
Rocky Canyon	117.5; 129.5	831.9; 917.0	14.1
Bulldog	3.6; 3.9	517.4; 570.3	0.7
Lightning	94.4; 104.1	801.0; 882.9	11.8
Scriver	373.9; 412.1	864.1; 952.5	43.3
Pyle	164.8; 181.7	435.6; 480.2	37.8
Anderson	523.6; 577.2	1283.9; 1415.3	40.8

*Current sediment loads from USDA Forest Service managed lands only, Gravel and dirt roads grouped together.

Table 11: BoiSed Percent Above Background Results by Reach

Reach	Management (tons/yr)	Background (tons/yr)	Percent Above Background (%)	Cumulative Percent Above Background (%)
R1	308.2	2258.5	14	14
R2	126.2	572.3	22	15
R3	1284.9	3218.0	40	28
R4	104.1	838.5	12	26
R5	172.8	1911.7	9	23
R6	593.8	1432.7	41	25
R7	577.2	1415.3	41	27

In addition to these modeled results, a geomorphic risk assessment for sediment has also been conducted within the Middle Fork Payette (Fitzgerald et al., 1998a). This assessment identified those sub-watersheds most likely to contain the largest amount of deliverable sediment. Sub-watersheds with high natural (i.e., background) sediment yields are Lightning, Big Bull Dog and Groundhog. Pure sub-watersheds that are likely to deliver the largest anthropogenic sediment loads to the Middle Fork Payette River include: Anderson; Scriver; Lightning; Sixmile; West Fork; and Wet Foot. Composite sub-watersheds that have substantial anthropogenic sediment yields are: Pyle; Rocky Canyon; Bridge; and Groundhog. The geomorphic risk assessment also identifies those watersheds with a high risk for *internal* sediment problems due to anthropogenic sources. These watersheds include: Anderson; Scriver; Lightning; Sixmile; West Fork; Wet Foot; and Silver.

A cooperative sediment trend monitoring study with the EPA, IDEQ, and the USDA Forest Service is currently being conducted within the Middle Fork Payette sub-basin. The results of this effort are helpful in quantifying streamflow and captured bedload particle sizes within the Middle Fork Payette sub-basin. The draft report covering the 1998 data collection season presents bedload:discharge rating curves for two sites in the lower reaches of the Middle Fork Payette River based on 11 bedload samples. Estimates of the sediment load during the spring runoff period (late April through June) at these two sites indicate a load of 57.5 tons/m² at the confluence with Lightning Creek and 88.5 tons/m² at the site near the mouth. Note that theses data show an estimated increase in bedload sediment production as the length of flow within the alluvial portion of the sub-basin increases, a condition highly unlikely in an agrading river system.

Even though these numbers appear to be highly suspect, the bedload sediment production rates can be combined for a gross estimate of current sediment production for the Middle Fork Payette River sub-basin to estimate that about 73 tons/m² was generated from the Middle Fork Payette River sub-basin. This would indicate that, for the spring of 1998 runoff period, about 25,000 tons of bedload sediment were routed to the mouth of the Middle Fork Payette River (Fitzgerald et al., 1998b).

2.3.2. Beneficial Use Support Status

IDAPA 16.01.02.053 codifies IDEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses, relying heavily upon aquatic habitat and biological parameters, as outlined in the Water Body Assessment Guidance (WBAG) (IDHW 1996a). The WBAG requires the use of the most complete data available to make beneficial use support status determinations. Data collected within the Middle Fork Payette River sub-basin used in this analysis includes reconnaissance by IDEQ, Boise National Forest aquatic surveys, Boise National Forest baseline habitat evaluations, and Idaho Department of Fish and Game surveys. These data were evaluated to supplement Beneficial Use Reconnaissance Project (BURP) data and were collected according to IDEQ approved quality assurance and quality control guidelines, have been analyzed, collated, and are presented in Table 11.

In 1994 the EPA placed five tributaries and the mainstem of the Middle Fork Payette River on Idaho's §303(d) list as water quality limited due to excess sediment. These segments were carried forward to the 1996 list. The listed segments included: Anderson Creek, Lightning Creek, Scriver Creek, Bulldog Creek, Silver Creek, and the mainstem of the Middle Fork Payette River. All of the listed segments were located within the Boise National Forest and were determined to be water quality limited based on exceedences of the Boise National Forest Plan standards and guidelines (USDA, 1990) and best professional judgement. Guidance for listing water bodies as water quality limited provided by Region 10 of the EPA states that any determination of water quality limited status based on this type of exceedences and professional judgement can be re-examined (EPA, 1995).

The listed water quality limited segments within the Middle Fork Payette sub-basin were re-analyzed according to current Idaho water quality standards and the IDEQ Water Body Assessment Guidance (IDHW, 1996a) as specified under IDAPA 16.01.02.053 during the preparation of this TMDL.

Results indicate that the lower reaches (i.e., below Big Bulldog Creek) are not fully supporting cold water biota due to a high sediment load and subsequent changes to channel morphology. The narrative Idaho water quality standard for sediment states that "sediment shall not exceed quantities...which impair designated beneficial uses" (IDAPA 16.01.02.200.08). These lower reaches, therefore, are currently considered to be water quality limited based on the Idaho narrative water quality standard for sediment. Stream segments on the 1996 §303(d) list within the remainder of the watershed were found to fully support all designated and existing beneficial uses (Appendix A). The 1998 §303(d) list has not been submitted at the time of this report.

Table 6 shows the catagories of support for each waterbody within the Middle Fork Payette River Watershed. Assessments were only performed for designated or existing uses. Industrial water supply, wildlife habitat, and aesthetics beneficial use were in the "full support" catagory for all water bodies and do not show up on the table. Warm water biota beneficial use neither existed nor was designated and therefore is also not shown on the table. Details of these water body assessments are in Appendix A.

Bull trout have been identified as the most sensitive beneficial use species within the Middle Fork Payette. This means that the bull trout are the most intolerant to pollution and habitat degredation. Overwintering and migration of adult and sub-adult bull trout have been determined to be limited by the instream habitat conditions, specifically the lack of large pools, within the lower reaches of the Middle Fork Payette due to excess sediment and related morphology change. It is assumed by the IDEQ that objectives established for the success of this species will also benefit other fish within the Middle Fork Payette River.

Support status analysis by IDEQ indicates that the lower reaches of the Middle Fork Payette River are not providing full support to cold water biota beneficial uses. The impairment is generally a lack of habitat complexity and, more specifically, a homogeneous system lacking fish cover. The habitat simplicity found in the lower reaches is the result of excessive sediment accumulation. Essentially, this habitat simplicity means that there is no camoflauge, cover, and other requirements for fish survival. It is thought that the lower reaches of the Middle Fork Payette River has few places for fish to survive, and therefore, contains few fish. The few redband/rainbow trout observed in the impaired section appear to be using schooling suckers as cover. While juvenile recruitment appears to be sufficient, there are few adult and sub-adult salmonids.

The most significant factor in providing adequate/suitable living space is quality pools. Pools provide fish hiding areas through physical depth, collection of woody debris, surface/bubble film, and scoured substrate. Bear Valley Creek, to the north of Middle Fork of the Payette is similar in gradient and sediment load. Pools, two meters in depth, have been used to evaluate sediment reduction in Bear Valley. Currently there are only two two-meter pools on the last 10 km (impaired section) of Middle Fork Payette.

As mentioned, changes to stream morphology within the lower reaches of the Middle Fork Payette stem from excessive sedimentation. An increase in large pool formations within these lower reaches would improve the identified beneficial use support within these reaches. Large pool formation should be favored by a decrease in sediment load. However, recovery based upon load reduction could take a long time and might be accelerated by construction of instream structure. Consideration of such treatment of symptoms is not the purpose of a TMDL, but may be considered in implemention, as a compliment to load reductions.

2.4. Pollution Control Efforts

2.4.1 Forestry

Throughout the Middle Fork Payette River sub-basin awareness has increased as a result of the Boise National Forest Plan (USDA, 1990). Additionally, the Rules and Regulations pertaining to the Idaho

Forest Practices Act (IDAPA 20.02.01) have caused both State and private timber managers to take actions which reduce sediment production due to timber management. Present timber harvests, road building and maintenance, and livestock grazing management have all shown an overall improvement in relation to water quality within the watershed.

Since the late 1970's, all federal, state, and private forest land managers have followed a strict set of harvesting guidelines specifically written to minimize or prevent erosion and sedimentation of streams. The requirements of these guidelines are intended to meet or exceed the Idaho Forest Practices Act. These guidelines have been updated several times as new technologies have been developed.

Specific activities within the Middle Fork Payette River sub-basin include: reconstruction of many older roads to meet current standards, improved drainage structures, water bars, grass seeding, and relocating out of riparian areas; natural dirt roads have been surfaced with gravel and pavement to eliminate road surface erosion; temporary road closure activities with gates and/or berms; and permanent road closure activities. Ongoing efforts include ongoing inspection and routine maintenance for areas managed by all of the land managers within the Middle Fork Payette River sub-basin.

2.4.2 Agriculture and Grazing

Agricultural Best Management Practices (BMP's) have been implemented in Boise and Valley Counties with great success. The no-till conservation farming of alfalfa reduces the sediment production off of these lands greatly. Water and sediment control structures and grassed waterways reduce overland flow and subsequent gully erosion on cropland. Fencing, livestock access ramps, pasture and hay land management, and proper grazing use are other BMP's used to improve livestock grazing and management.

Sediment reduction incentive programs available to landowners within the Middle Fork Payette River sub-basin have included cost-share incentives. Prior to the 1990's these programs were administered through the Farm Service Agency's (formerly the ASCS) Alternative Conservation Program (ACP). Under this program site specific BMP's were implemented to reduce livestock impacts to streams and other water bodies. These BMP's consisted of fencing, ponds, off-site watering systems, spring developments, and no-till farming practices.

3. TMDL Target, Analysis, and Allocation

3.0. Introduction

In 1994 the EPA placed five tributaries and the mainstem of the Middle Fork Payette River on Idaho's 303(d) list as water quality limited due to excess sediment. These segments were carried forward to the 1996 list. The listed segments included: Anderson Creek, Lightning Creek, Scriver Creek, Bulldog Creek, Silver Creek, and the mainstem of the Middle Fork Payette River. All of the listed segments were located within the Boise National Forest and were determined to be water quality limited based on exceedences of the Boise National Forest Plan standards and guidelines (USDA, 1990) and best professional judgement. Guidance for listing water bodies as water quality limited provided by Region 10 of the EPA states that any determination of water quality limited status based on this type of exceedence and professional judgement can be re-examined (EPA, 1995).

The listed water quality limited segments within the Middle Fork Payette sub-basin were re-analyzed according to current Idaho water quality standards and the IDEQ Water Body Assessment Guidance (IDHW, 1996a) as specified under IDAPA 16.01.02.053 during the preparation of this TMDL.

Results of the Water Body Assessment for the Middle Fork Payette River indicate that the lower reaches (i.e., below Big Bulldog Creek) are not fully supporting cold water biota due to a high sediment load and subsequent changes to channel morphology. The narrative Idaho water quality standard for sediment states that "sediment shall not exceed quantities...which impair designated beneficial uses" (IDAPA 16.01.02.200.08.). These lower reaches, therefore, are currently considered to be water quality limited based on the Idaho narrative water quality standard for sediment. Stream segments on the 1996 §303(d) list within the remainder of the watershed were found to fully support all designated and existing beneficial uses (Appendix A).

Section 303(d) of the Federal Clean Water Act requires States to develop a Total Maximum Daily Load (TMDL) management plan for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point and nonpoint sources. TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint sources, including a margin of safety and natural background conditions. There are no National Pollution Discharge Elimination System (NPDES) pollutant sources present within the Middle Fork basin at this time. Therefore, the entire allocation specified within this TMDL is a LA for nonpoint sources only.

Over the past 80 years an excessive sediment load within the Middle Fork Payette River has resulted in channel and habitat alteration. Mechanical changes to the system (e.g., channel straightening, removal of organic debris, and/or dredging) has been minimal. In other words, the sediment pollutant load over time has been the primary cause of channel morphology alterations. These alterations, in combination with an ongoing high sediment load, are the main factors impairing beneficial use support within the lower reaches. Changes to the current channel morphology should be favored by a decrease in sediment production within the watershed, however, this may take a long time and recovery could be accelerated by construction of instream structure along with load reductions.

The goal of the narrative sediment standard is to manage past and present sediment loads so that the designated and existing beneficial uses receive full support. However, "habitat modification or alteration" is not specified as a pollutant under the Clean Water Act or Idaho water quality standards. Therefore, a waterbody impaired by habitat alteration alone (e.g. does not result in or is not a product of a pollutant) is not considered water quality limited and a TMDL is not required.

In the case of the Middle Fork Payette River TMDL, even though channel morphology and habitat alterations have resulted from the sediment pollutant load, targets are established to address sediment load limitations only (i.e., targets do not include any requirements for in-stream channel modifications). Attainment of these sediment targets or attainment of beneficial use support will indicate that the narrative sediment water quality standard is achieved.

3.1. Data Gaps

3.1.1. Fisheries

Most of the fishery information collected in this watershed are from the upland tributaries. Since the lower section of the Middle Fork of the Payette has relatively low numbers of fish, is not administered by Boise National Forest (who does most of the inventories in this area), and is dominated by non-game fish, it has not been intensively monitored. An inventory of juvenile species composition within the lower reach stream margins is also lacking at this time.

Obtaining this additional information on fish presence and usage would allow an improved diagnosis for the specific needs of designated and existing species within the lower reaches. This information is also needed to determine both the current baseline for cold water biota support and to provide a measure of beneficial use recovery. Because of these diagnostic and ongoing needs to determine cold water biota support status, it is evident that a fish inventory for both game and non-game fish in the lower Middle Fork Payette river is a data gap.

3.1.2. Mass Wasting

Mass wasting events have been a large component of the historical sediment load entering the Middle Fork Payette River (Gray and Megahan, 1981; Megahan et al, 1978). The large rain-on-snow events in 1965, the early 1970s, and in 1997 contributed to numerous slides within sections of the Middle Fork Payette sub-basin. During the development of this TMDL it became apparent that the lack of adequate prediction/planning tools for mass wasting for background and managed forest systems is a serious data gap at this time.

A twenty year sediment production study was conducted by the USDA Forest Service within the Silver Creek Experimental Area, located within the Silver Creek sub-watershed of the Middle Fork Payette River sub-basin. This study provides relatively good estimates of background rates of sediment input from both hillslope creep and landslides (Clayton and Megahan, 1985). The Silver Creek study also showed how forest management within this sub-watershed did not increase peak flows or frequency, but did increase sediment input to Silver Creek from surface erosion (Megahan et al, 1995). The planning model used by the Boise National Forest, BoiSed, uses results of this study in order to predict the effects of past and future management activities on sediment production within the Middle Fork Payette sub-basin. Management activities modeled include road construction, timber harvest, and fire (Potyondy et al, 1990).

A supplemental component of BoiSed looks at the increase in mass wasting due to management activities (Reinig et al, 1991). This mass erosion is designed to predict shallow debris and avalanche-debris flows stemming from new road construction. Within the model's framework, as the age of the road increases, the mass erosion acceleration factor generally decreases. This approach has inherent limitations for evaluating the effects of episodic rain-on-snow events on management induced landslides. As has been seen during recent harvest planning efforts within the Lightning Creek sub-watershed, as the age of the road increases, the mass wasting potential does not necessarily decrease.

Another planning tool, called SedMod, has been developed by Boise Cascade to predict management increases to sediment production in forested basins. This model relies on the Washington State Cumulative Effects Watershed Assessment Protocol for determining hillslope creep for background sediment production and surface erosion from roads for management induced sediment production. This model is currently under development and results from the initial runs presented in this TMDL may change. Also, while attempts are currently under way to evaluate background and management induced mass wasting, this aspect of sediment production is still not represented within SedMod (Glass, 1998).

The current Middle Fork Payette TMDL sediment load and required reductions reflect this data gap. The targets presented within this TMDL for hillslope sediment production are in terms of "percent above background". These target "percent above background" values are based on changes in sediment accumulation within the Middle Fork Payette as estimated background sediment input levels are increased. This, in combinations with modeled background and current load estimates, establishes a quantitative target load for the average annual sediment input for all types of erosion processes (Table 13). Current load estimates and estimated load reductions needed in order to meet these targets, however, do not include increases to mass wasting due to management activities. Because a current load estimate and required load reductions are considered to be critical elements for TMDL approval, those values available at this time are presented here. On going reconnaissance and model development to be completed during the implementation phase of this TMDL will provide improved values for current sediment loads and required reductions (see Section 4).

3.1.3. Sediment Transport Capacity

This TMDL establishes a target for sediment input in terms of "percent above background" based on a 50% increase in reach deposition rates over background deposition rates. These results are based on average annual background sediment input rates entering the Middle Fork Payette River. Current cross-section geometries at selected points have been used to represent average reach conditions. These simplifications combine with the annual variability for flow and sediment input to make it unlikely that the exact deposition rates estimated here would be present within the Middle Fork Payette River. New data, information, or model refinements to this approach will most likely lead to improvements in future applications.

It is generally recognized that sediment input increases which result in observable changes in stream characteristics are detrimental to fisheries, however, it is extremely difficult to identify the point where these increases begin to affect reach deposition, transport capacity, and changes to particle size distributions (Chapman and McLeod, 1987; Potyondy et al, 1991). Prior to this TMDL, a threshold of 100% above background was selected as "excessive sediment" by the USDA Boise National Forest. This threshold was determined by an observation by Potyondy et al. (1991) that impacted conditions within the Middle Fork Payette River were a result of levels above background of as much as 200%. It was observed that these levels were too high based on the observed channel conditions. It was recommended to reduce these historical levels by 50%, or, in other words, set a threshold for sediment production to 100% above background sediment levels (Potyondy et al, 1991).

This TMDL is faced with a similar quandary as the Forest Service was when establishing a sediment production threshold. While it is apparent that the current levels of hillslope sediment production are "excessive" based on the support status of the lower reaches, the degree of excess sedimentation is difficult to quantify at this time. By selecting an increase in reach deposition of 50% over background as the load capacity it is recognized that improvements to the lower reaches will occur (i.e., the amount of sediment currently entering the impaired reaches would need be reduced by half). However, whether these improvements are great enough to meet beneficial use support, either on their own or through additional measures, is unknown at this time. Ongoing IDEQ beneficial use support status analysis, in combination within on going reconnaissance efforts and implementation plan development as described in Section 4, will identify whether the initial reductions established here are adequate for beneficial use support.

3.2. Sediment TMDL Analysis

3.2.1. Identified Pollutant Impacts

The Middle Fork Payette River typically receives sediments from landslides, forest roads, and exposed soil areas due to construction and agriculture activities. Gravel sized sediments (5 mm) originating in the upper watershed and tributaries are routed down steep channels and accumulate in the flatter reaches in the lower portion of the basin. Sediment monitoring over the past year has indicated that the sediment loads entering the Middle Fork Payette do not produce high turbidities or suspended sediments, but do contribute a large amount of material to the bedload (Fitzgerald et al, 1998b). The primary nonpoint sources (NPS) of pollutants in the Middle Fork Payette River basin are forest management activities, grazing, small scale agriculture operations, county road construction and management, urban runoff, and land development activities.

The narrative Idaho water quality standard for sediment states that "sediment shall not exceed quantities...which impair designated beneficial uses" (IDAPA 16.01.02.200.08.). The sediment targets established by this document is an interpretation of this narrative water quality standard. Section 2 of this TMDL examines how the identified beneficial uses are impacted due to excess sediment. Based on this analysis targets are established for an allowable amount of sediment above background for each of the impaired reaches within the Middle Fork Payette sub-basin.

Sediment loads can be characterized by their frequency of delivery, particle size compositions, and amounts. For example, surface erosion from new road construction can deliver fine sediments to a stream on a frequent basis over a two to three year period. The high frequency of this delivery can combine with a large amount of available material when many new roads are constructed at once, thus producing a large sediment load. Once a road has aged a few years, the frequency and amount of fine sediment delivery diminishes dramatically. Debris flows and other forms of mass wasting, on the other hand, can deliver a large amount of fine and coarse sediments to a stream during a single event. The remaining debris flow paths which remain after the event can produce surface erosion for a few years, much like a newly constructed road. Additional characteristics of debris flow deliveries are that they often occur during high stream flow events and occur less frequently than new road construction surface erosion sediment delivery events.

In order to define an excessive sediment load, the receiving body's assimilative capacity needs to be evaluated. Assimilative capacities of a receiving body can change according to flow, sediment particle size, and channel geometry. Frequent delivery of fine sediments from excessive surface erosion is thought to impact the channel bed surface composition, shifting the composition from a more coarse to a more fine particle size distribution. Frequent delivery of coarse and fine sediments from frequent mass wasting, on the other hand, is thought to impact the channel geometry by shallowing and widening it. Additionlly, the frequency of sediment delivery can influence a stream's assimilative capacity. Rare and infrequent mass wasting events, for example, tend to cause few changes to the channel geometry. If the frequency of these events increase, the channel may accommodate these ongoing sediment loads by widening and shallowing. This follows the observations that as the sediment load increases over a long period, the channel configuration changes in order to accommodate (i.e., transport) this sediment load.

3.2.2. Sediment Loading Analysis

A total maximum daily load (TMDL) is the maximum amount of pollutant that can enter a waterbody so that the State's water quality standards will be met. These thresholds can also be considered the "load capacity" that meets, or works towards, beneficial use support. TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint sources, including a margin of safety and natural background conditions. There are no National Pollution Discharge Elimination System (NPDES) pollutant sources present within the Middle Fork basin at this time. Therefore, the entire allocation specified within this TMDL is a LA for nonpoint sources only. In other words, the load capacity for the Middle Fork Payette includes a margin of safety and allocations of load to nonpoint pollutant sources.

While it is intended that loading analyses be a quantitative assessment of pollutant loads, federal regulations allow that 'loads may be expressed as mass per unit time, toxicity, or other appropriate measures' (40 CFR 130.2). In many cases, less data is available than may be considered optimal for a quantitative loading analysis. This can not delay TMDL development. In his September 26, 1996 ruling, Judge Dwyer made it clear that a 'lack of precise information must not be a pretext for delay' (see Idaho Sportsman's Coalition vs. Browner, Case No. C93-943WD, WD Washington). Federal regulations also acknowledge the 'load allocations are best estimates of the loading, which may vary from reasonably accurate estimates to gross allotments' (40 CFR 130.2(g)).

For narrative criteria, e.g. sediment and nutrients, the measure of attainment of Idaho's water quality standards is full support of beneficial uses. Water quality targets are recommended in many instances of narrative criteria violations due to the long recovery period (i.e., greater than 5 years). Idaho's short TMDL development schedule and the regulatory allowances mentioned above point to phased or iterative TMDL load capacity estimates. In these types of TMDLs much is yet unknown and the initial loading analysis may be inexact with a large margin of safety to account for uncertainty.

The load capacity and allocations proposed for the Middle Fork Payette River within this TMDL are based on the results of an analysis of reach transport capacity. This analysis utilizes the current reach geometry characteristics, estimated background sediment levels from BoiSed, the Parker Transport Capacity Equation, and a sediment transport coefficient. Essentially, background sediment rates are estimated using BoiSed; the amount of sediment transported to a stream from an upslope activity is estimated using a sediment transport coefficient; and the transport capacity and rate of deposition down the mainstem of the Middle Fork Payette is estimated using the Parker Transport Capacity Equation. The rate of sediment deposition was then increased until the rate of deposition within each reach was 50% above estimated background deposition rates. This establishes the load capacity in terms of a "percent about background". Nonpoint land use load allocations and a margin of safety combine to make up the identified load capacity.

3.2.3. Sediment Allocations and Margin of Safety

As already stated, TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocation (WLA) for point sources and Load Allocation (LA) for nonpoint sources, including a margin of safety (MOS) and natural background conditions. And, the Middle Fork Payette TMDL addresses pollutant loading from nonpoint sources only. Allocations are presented for each of the impaired reaches of the Middle Fork Payette River. These allocations specify load capacities, target nonpoint management load allocations, and a margin of safety based on the estimated background loads for each of the contributing areas to the impacted reaches. The load allocation in terms of "percent above background" identified for each sub-watershed are estimated based on the portion of the total load that can be contributed by management activities.

Where uncertainty exists (and this is almost always the case) about the amount of pollutant a water body can reasonably assimilate, federal law requires a margin of safety (MOS) be included in the calculations. The MOS may be numerical or be incorporated in conservative assumptions used to establish the TMDL. The MOS is intended to ensure that water quality goals will be met even though uncertainty in the loading capacity exists.

Table 12 summarizes the results of these transport capacity estimates for each reach analyzed. Reaches 5, 6, and 7 (see bold) are the impaired reaches. Load capacities and allocations are established for the contributing areas to these three reaches. The contributing area for Reach 5 includes the entire sub-basin area upslope and upstream of a point just downstream of the confluence between Lightning Creek and Middle Fork Payette River. The contributing area for Reach 6 includes the entire sub-basin area upslope and upstream of a point just upstream of the confluence between Anderson Creek and the Middle Fork Payette River. The contributing area for Reach 7 is the entire Middle Fork Payette sub-basin drainage.

Table 12: Sediment Input Rate Results by Reach

Reach	Background Input Entering MF Payette (tons/yr)	Background Rate of Deposition (tons/yr)	Target Rate of Deposition (tons/yr)	Load Capacity (% above background)	Cumulative Load Capacity* (% above background)
R1	78.3	4.6	6.9	50	50
R2	11.0	3.3	5.0	44	48
R3	58.4	2.5	3.8	49	47
R4	22.9	0.9	1.3	50	48
R5	**76.3**	**17.9**	**26.8**	**56**	**50**
R6	**60.3**	**39.5**	**59.2**	**26**	**46**
R7	**75.0**	**32.5**	**48.7**	**48**	**47**

*Based on increases to BoiSed background amounts delivered to each stream reach.

These results are based on estimated average annual background sediment input rates entering the Middle Fork Payette River. Current cross-section geometries at selected points have been used to represent average reach conditions. These simplifications combine with the annual variability for flow and sediment input to make it unlikely that the exact deposition rates estimated here would ever be present within the Middle Fork Payette River. While it is apparent that the current levels of hillslope sediment production are "excessive" based on the support status of the lower reaches, the degree of excess sedimentation is difficult to quantify. By selecting an estimated increase in reach deposition of 50% over background it is recognized that the current sediment load will need to be reduced by half and that, through these reductions, improvements to the lower reaches will occur.

This TMDL establishes a sediment production threshold for the impaired reaches (R5, R6, and R7) that will achieve the Idaho water quality criteria for sediment and beneficial use support. A sediment load capacity and allocations for nonpoint management activities within the Middle Fork Payette River for these three reaches are proposed by this TMDL in terms of a "percent above background". Table 13 lists the management target input in both "percent above background" and "tons per year" for each of the sub-watersheds. The "tons per year" estimates are a function of estimated background loads based on the research conducted at the Silver Creek Experiment Area adapted for use in BoiSed.

Table 13: Load Capacity, MOS, and Management Targets

Reach	Cumulative Load Capacity (% above background)	Cumulative Load Capacity (tons/yr)	Cumulative Background Load (tons/yr)	Cumulative Margin of Safety (tons/yr)	Cumulative Management Allocation (tons/yr)	Cumulative Management Allocation (% above bkgrd)
R1	50	4624	3083	462	1079	35
R2	48	5600	3761	560	1279	34
R3	47	10164	6883	1016	2260	33
R4	48	11867	8002	1187	2678	33
R5	**50**	**13391**	**8978**	**1339**	**3074**	**34**
R6	**46**	**15076**	**10317**	**1508**	**3251**	**32**
R7	**47**	**16806**	**11470**	**1681**	**3655**	**32**

Current load estimates, also in terms of "percent above background", as estimated by the SedMod sediment production model (Glass, 1998) are presented in Table 14 to show preliminary sediment reductions required for the impaired reaches. Each of the required sediment reductions apply to the entire contributing areas of each of the impaired reaches, for all times of the year, for all forms of sediment inputs to the Middle Fork Payette River.

Table 14: Current Cumulative Sediment Loads, Cumulative Management Allocations, and Required Sediment Load Reductions*

Reach	Cumulative Current Load Estimate (% above bkgrnd)	Cumulative Management Allocation (% above bkgrnd)	Required Sediment Load Reduction (% above bkgrnd)
R1	35	35	0
R2	39	34	5
R3	62	33	29
R4	64	33	31
R5	**54**	**34**	**20**
R6	**67**	**32**	**35**
R7	**65**	**32**	**33**

*Current load estimate for percent above background based on SedMod (Boise Cascade, 1998).

Land use and related activities within the Middle Fork consist of related timber harvest activities and recreations in all of the sub-watersheds except Pyle. Therefore, the allocations established for Reach 5 are for those activities related to timber harvesting and recreation. Allocations established for Reaches 6 and 7, which receives contributions from the Pyle sub-watershed, however, apply to agricultural, grazing, and urban nonpoint source activities in addition to timber harvest and recreation related nonpoint source activities. Table 15 shows the breakdown in acreage and in the proportional contributions of each of the identified activities within the Pyle sub-watershed that contribute to the nonpoint sediment load according to a proportioning analysis conducted using the Watershed Erosion Prediction Project (WEPP) model (Agricultural Research Service, 1997; Elliot et al, 1997; Flanagan and Livingston, 1995; IDEQa, 1998).

Table 15: Nonpoint Source Activity, Acres, and Proportion of load from the Pyle Sub-Watershed

Activity	Acres	Proportion of Sediment Load
Roads	471	97.4%
Pasture	5000	2.0%
Hay: 0-5% Slopes	1500	0.0%
Hay: 6-20% Slopes	500	0.4%
Urban	640	0.1%
New Construction: 0-5% Slopes	25	0.1%
New Construction: 6-20% Slopes	6	0.1%
Forest	11418	0.0%
Total	19560	100%

Note that the roads listed in this table are owned by a variety of agencies and are used for timber harvest, recreation, residence access, and agriculture and pasture access. Also note that the allocations specified for Reaches 6 and 7 include the entire contributing areas for each of these reaches, of which the Pyle sub-watershed composes a small portion. Refinement of these allocations will be required during the development of specific actions for sediment reductions during the implementation phase of this TMDL.

A complete loading analysis, in conjunction with an implementation plan, lays out a general pollution control strategy and an expected time frame in which water quality standards will be met. For narrative criteria, e.g. sediment and nutrient, the measure of attainment of Idaho's water quality standards is full support of beneficial uses (IDEQb, 1998). Long recovery periods (greater than five years) are expected for implemented TMDLs dealing with non-point sediment sources. Because of the expected long term recovery periods, the Middle Fork Payette River TMDL allows for short term increases in sediment production as a result of restoration and timber management activities that will reduce overall sediment production in the long term. Water quality targets in these cases may be recommended by the IDEQ to ensure overall TMDL compliance.

The Clean Water Act §303(d) specifies that, for those waters identified as water quality limited, a TMDL must be established "at a level necessary to implement the applicable water quality standards **with seasonal variations** and a **margin of safety** which takes into account any lack of knowledge concerning that relationship between...*these*...limitations and water quality" (emphasis added). This TMDL meets these requirements by establishing sediment targets within the Middle Fork Payette Sub-basin Assessment and TMDL in terms of a "percent above background" based on the **bankfull discharge** from the Middle Fork Payette River resolved into an estimated **annual background and current annual sediment load**. This means that the allocations established by this TMDL are in terms of a percent above background of the **annual sediment load**. Flexibility to quantify the load capacity and allocations in annual verses daily sediment loads is provided in 40 CFR Part 130.2(i). Note that the Middle Fork Payette River is an unregulated system, flows occur according to seasonal patterns and annual variations. Therefore, the annual allocations established reflect the Middle Fork Payette seasonal patterns and annual variations due to the flexibility inherent in evaluating the sediment yield in terms of a "percent above background". The IDEQ asserts that if these sediment targets are attained the support of the beneficial uses will improve. Additionally, the IDEQ expects these sediment targets to be adjusted over time as progress towards beneficial use support is made and efforts to improved current sediment load estimations continue. Specific on going efforts to improve current sediment loads within the sub-basin are described more fully in Section 4.

This TMDL establishes a hillslope sediment production threshold. It should be noted that the transport capacity model uses physical parameters and inputs that are not based on conservative assumptions, however, the load capacity specified includes not only surface erosion, but mass wasting contributions as well. Therefore, in addition to the margin of safety that has been applied, the allocations are considered conservative due to the use of background estimates that include mass wasting.

4. Implementation Plan Development Strategy

The IDEQ is currently finalizing guidance for development of TMDLs. This guidance suggests that implementation plans are an essential step in the process of restoring beneficial uses and assuring compliance with water quality criteria. These plans lay out a schedule of specific actions to be undertaken and are to be developed in accordance with the water quality goals and load allocations provided in a TMDL. Draft IDEQ guidance for implementation plan development states:

"An implementation plan is guided by an approved TMDL and provides details of actions needed to achieve load allocations, a schedule of those actions, and follow up activities to document progress or provide other desired data. Implementation plans specify the local actions that lead to the goal of full support of beneficial uses. Important elements of these plans are:

- *Planned actions are based on the load allocations in the TMDL*
- *Time line which specifies when water quality standards are expected to be met, including goals or milestones as deemed appropriate*
- *Schedule of what, where, and when actions to reduce loads are to take place*
- *Identification of who will be responsible for undertaking each planned action*
- *Specification of how accomplishments of actions will be tracked*
- *Follow-up monitoring plan to refine TMDL and/or document attainment of water quality standards, including details of evaluation and reporting of results*

There may be more than one implementation plan which cover different water quality limited waterbodies within a sub-basin. An implementation plan (or plans) is expected within 18 months of approval of a TMDL.

Writing of these plans is the charge of the WAG and designated agencies in Idaho's water quality law, with assistance from IDEQ. IDEQ will be a repository for implementation plans and will incorporate them in the Idaho's Water Quality Management Plan" (IDEQb, 1998).

As the draft guidance suggests, *"a complete loading analysis, in conjunction with an implementation plan, lays out a general pollution control strategy and an expected time frame in which water quality standards will be met. For narrative criteria, e.g. sediment and nutrient, the measure of attainment of Idaho's water quality standards is full support of beneficial uses. Long recovery periods (greater than five years) are expected for implemented TMDLs dealing with non-point sediment or temperature sources. Along with the load reductions, these targets set the sideboards in which specific actions are scheduled in the subsequent implementation plan"* (IDEQb, 1998).

Because of the expected long term recovery periods, the Middle Fork Payette River TMDL allows for short term increases in sediment production as a result of restoration and timber management activities that will reduce overall sediment production in the long term. Water quality targets in these cases may be recommended by the IDEQ to ensure overall TMDL compliance.

The draft IDEQ TMDL development guidance also suggests that monitoring to ascertain achievement of water quality goals is an essential part of implementation plans. Instream monitoring and assessment of water quality is to be done by IDEQ. Implementation monitoring will be done by designated state agencies as defined in IDAPA 16.01.02.003.23 (IDEQb, 1998).

4.1. Mechanisms for Implementation of Nonpoint Source Reductions

Nonpoint source reductions listed in the Middle Fork Payette TMDL will be achieved through the combined authorities the State of Idaho possesses within the Idaho Nonpoint Source Management Program and commitments the community makes in the future Middle Fork Payette Sub-basin Implementation Plan. Section 319 of the Federal Clean Water Act requires each state to submit a management plan to EPA for controlling pollution from nonpoint sources to waters of the state. The 319 Plan must do the following: identify programs to achieve implementation of the best management practices (BMPs); outline a schedule containing annual milestones for utilization of the program implementation methods and for implementation of BMPs; and provide a listing of available funding sources for these programs. The current Idaho Nonpoint Source Management Program has been approved by EPA as meeting the intent of Section 319 of the Clean Water Act.

As described in the Idaho Nonpoint Source Management Plan, the Idaho Water Quality Standards require that if water quality monitoring indicates water quality standards are not met due to nonpoint source impacts, even with the use of current BMPs, the practices will be evaluated and modified as necessary by the appropriate agencies in accordance with the provisions of the Administrative Procedure Act. If necessary, injunctive or other judicial relief may be initiated against the operator of a nonpoint source activity in accordance with the Director's authorities provided in Section 39-108, Idaho Code (IDAPA 16.01.02.350). The Idaho Water Quality Standards list designated agencies responsible for reviewing and revising nonpoint source BMPs based on water quality monitoring data as is generated through the state's water quality monitoring program (IDAPA 16.01.02.003).

Existing authorities and programs to ensure implementation of BMPs to control nonpoint sources of pollution in Idaho include:

State Agricultural Water Quality Program	Nonpoint Source 319 Grant Program
Wetlands Reserve Program	Conservation Reserve Program
Environmental Quality Improvement Program	Resource Conservation and Development
Idaho Forest Practices Act	Agricultural Pollution Abatement Plan
Water Quality Certification For Dredge and Fill	Stream Channel Protection Act

As designated "Responsible Land Management Agencies", both the USDA Forest Service and the USDI Bureau of Land Management have entered into a Memorandum of Understanding (MOU) between the EPA and various State of Idaho agency departments (IDHW, 1993). Within the Forestry Practices Appendix to this MOU, the federal agencies have agreed to comply with the water quality protection provisions of the Idaho Forest Practices Act Rules and Regulations. Additionally, federal agency responsibilities are defined in 40 CFR Part 130 as needing to comply with State requirements to control water pollution to the same extent as private entities.

Upon approval of this TMDL by EPA Region 10, a Middle Fork Payette River TMDL Implementation Plan will be developed by designated supporting agencies and stakeholders. The Idaho Water Quality Standards directs appointed basin and watershed advisory groups to provide public review on recommended actions to achieve the water quality target listed in the Middle Fork Payette River TMDL.

The Middle Fork Payette River TMDL Implementation Plan will aim to be the most appropriate plan for nonpoint sediment source pollution controls. The Plan will list activities which are to be implemented by land managers within the community to enhance the water quality of the Middle Fork Payette River. The Plan will include specific actions to meet the TMDL targets and a schedule for implementation of each activity. These activities might include, but are not limited to: forest road reconstruction, road closures, ongoing road maintenance programs, slide stabilization projects, riparian tree plantings, agricultural best management practices, bioengineering structures, wetland restoration, urban storm water system upgrades, development of a tax relief policy for riparian areas, development of an erosion control ordinance and education and information programs to increase community awareness of the river's water quality conditions and the activities to be undertaken to restore the river's water quality.

4.2. Ongoing Efforts to Assess Current Sediment Loads

Idaho's short TMDL development schedule and the regulatory allowances point to phased or iterative TMDLs. In a phased TMDL much is yet unknown and the initial loading analysis may be inexact. The initial phase focuses on what is known. Progressive load reduction moves toward the eventual goal by targeting more obvious source problems in the implementation plan. Essential to this approach is inclusion, in the implementation plan, of a plan to gather the data needed to refine load estimates and their allocation. On going efforts to assess sediment loads within the Middle Fork Payette basin are presented here, with the caveat that these and other efforts will be better refined as the implementation plan is developed.

The IDEQ welcomes the assistance of other agencies, or private organizations, with the resources and interest in TMDL implementation plan development and on going efforts to assess current pollutant loads. Additionally, the IDEQ recognizes that many others hold information and expertise and encourage these agencies to work with the appointed Middle Fork Payette Watershed Advisory Group and stakeholders during TMDL development and implementation (IDEQb, 1998).

On going studies relevant to the Middle Fork Payette River Sub-basin in general, but not necessarily to the establishment of this TMDL, include: 1) baseline monitoring sites (USDA Forest Service, Boise National Forest); 2) Idaho Department of Water Resources Basin Plan; and 3) IDEQ Bull Trout Problem Assessment. Additional on going studies relevant to the Middle Fork Payette River Sub-basin specific to sediment load descriptions and analysis include: 1) a land slide inventory (Boise Cascade Corporation); 2) SedMod model application refinements and general model refinements; 3) Idaho Department of Lands Cumulative Effects Watershed Procedure; and 4) Middle Fork Payette River Sediment Trend Monitoring (EPA, IDEQ, and USDA Forest Service, Boise National Forest).

4.2.1. Landslide Inventory

The need for an adequate prediction and planning tool to assess background and management induced rates of mass wasting was identified as a serious data gap during the development of this TMDL. However, the lack of appropriate historical data, combined with a lack of an adequate sub-basin reconnaissance for current land slide features, prevented the development of this prior to submittal of this TMDL.

In order to address this data gap, the Boise Cascade Corporation has begun to develop a GIS based land slide inventory data set on current and historical land slide events within the region (Glass, 1998). This effort is being conducted in cooperation with the USDA Forest Service, IDEQ, and others. Because the sediment reduction targets established by this TMDL include a mass wasting component, it is important for this effort to continue in a cooperative manner with all effected responsible land management agencies so that they may justify and defend their management actions within the Middle Fork Payette sub-basin.

4.2.2. Boise Cascade SedMod Model Improvements

Improvements are in the process of being made to Boise Cascade's SedMod sediment prediction model. These improvements include a quality control check for stream initiation locations within the Middle Fork Payette River sub-basin in addition to modifications to the SedMod model itself (Glass, 1998).

4.2.3. Idaho Department of Land's Cumulative Watershed Effects Procedure

A Cumulative Watershed Effects (CWE) inventory is expected to be completed by the Idaho Department of Lands during the summer of 1999. Field data collection and reconnaissance was finished during the fall of 1998, review and data reduction is planning to be completed during the winter of 1999, with the final report to be available summer of 1999.

The CWE process was developed in order to meet antidegradation provision specified by the Clean Water Act. The concept of cumulative effects suggest that, while impacts from any single forest practice may not exceed Idaho water quality standards if BMPs are properly applied, impacts from a series of practices may add up to Idaho water quality standard exceedences. The CWE process is designed to first examine conditions in a watershed surrounding a stream, then attempts to identify causes of the conditions, and finally, to identify actions that will correct any identified adverse conditions. It is the identification of actions to correct identified adverse conditions that should prove especially useful to the Middle Fork Watershed Advisory Group during TMDL implementation plan development.

4.2.4. Middle Fork Payette River Sediment Trend Monitoring

The purpose of the Middle Fork Payette River Sediment Trend Monitoring is to collect information on the surface water sediment conditions within the Middle Fork Sub-basin to: 1) isolate the form of sediment impairing beneficial uses (i.e., turbidity vs bedload impacts); 2) characterize existing sediment load trends; and 3) validate predictive sediment equations. This is a cooperative monitoring effort funded by the EPA and involving personnel from the EPA, IDEQ, and the USDA Forest Service. So far the data collected has provided: 1) stage:discharge relationships at two sites along the Middle Fork Payette River; 2) a general partitioning between suspended and bedload within the lower reaches of the Middle Fork Payette River; 3) the average particle size for captured bedload at two sites along the Middle Fork Payette River; 4) a general comparison between the bedload grain size captured and the substrate grain size at two sites along the Middle Fork Payette River; 5) estimated bedload vs discharge curves for two sites based on 11 bedload samples; and 6) estimated bedload vs discharge curves for 9 tributaries to the Middle Fork Payette River based on one bankfull discharge bedload measurement (Fitzgerald et al, 1998b).

4.3 Revisions to TMDL Objectives During TMDL Implementation Phase

As the draft IDEQ guidance for TMDL development states: *"a phased approach is often appropriate when nonpoint sources are a large part of the pollutant load, information is limited, or narrative criteria are being interpreted"* (IDEQb, 1998). Each of these considerations apply to the Middle Fork Payette TMDL. Under these circumstances there is a great deal of uncertainty in the loading analysis, load capacity and its allocation.

The draft IDEQ guidance for TMDL development suggests in these cases that: *"this uncertainty calls for a "ramping up" of implementation in which the more obvious sources of load reduction are scheduled for action first, with increasingly difficult and less cost effective load reductions scheduled further out in time. Essential to this strategy is gathering of information which will allow refinement of the loading analysis and document when restoration of beneficial uses occurs. The implementation schedule may be revised if additional data indicate an upward revision in the loading capacity (less load reduction required to meet beneficial uses then at first estimated), better than anticipated load reductions, or that water quality standards are met prior to full implementation"* (IDEQb, 1998).

5. Public Participation

IDEQ staff had numerous consultations and discussions with interested agencies and stakeholders during the development of the Middle Fork Payette River TMDL document. These agencies and stakeholders included the USDA Boise National Forest, the USDA Rocky Mountain Research Station, United States Environmental Protection Agency, Natural Resource Conservation Service, Idaho Department of Fish and Game, Idaho Department of Lands, Idaho Soil Conservation Commission, Boise County, Squaw Creek Conservation District, Boise Cascade Corporation., Idaho Conservation League, and local volunteers. The participation of these agencies and individuals has been, and will continue to be, important to the development of this and future documents within the Middle Fork Payette River sub-basin.

5.1. Southwest Basin Advisory Group

Idaho Code Title 39, Chapter 36 and IDAPA 16.01.02.052 provides requirements for public participation in TMDL development and water quality decisions. Basin Advisory Groups (BAGs) and, if formed, Watershed Advisory Groups (WAGs) are to review the development of the TMDL, advise Idaho State on impaired waterbodies, the management of impaired watersheds, and recommend specific pollution control activities.

The Southwest Basin Advisory Group (SWBAG) was appointed by the Administrator of the Idaho Division of Environmental Quality in 1996 to fulfill the public participation requirements of Idaho Code 39-3601 *et seq.* Under Idaho Code 39-3615, the SWBAG is charged with providing advice to the Idaho Division of Environmental Quality on the specific actions needed to control point and nonpoint source pollution impacting Middle Fork Payette River water quality. Members selected for the SWBAG were recommended from nominations obtained from the local community to represent specific stakeholder groups within the watershed.

The formation of a Watershed Advisory Group (WAG) for the Middle Fork Payette Sub-basin was suggested to the SWBAG through the public comments received. A WAG formation is expected to occur upon TMDL approval.

5.2. Middle Fork Payette Executive Committee and Task Force

The Middle Fork Payette River sub-basin assessment was originally a pilot effort by the IDEQ to determine the time, resources, and information needed to complete a sub-basin assessment. An interagency Executive Committee and Interdisciplinary Task Force was formed to provide guidance on Middle Fork Payette TMDL document development. This group met periodically throughout the development of this document.

5.3. Public Notification

To meet the various requirements for TMDL public involvement and review, the IDEQ completed the following steps:

- A 45 day comment period was held between September 3 and November 18,1998.
- Copies of the Draft Sub-basin Assessment and TMDL were presented to the SWBAG and cooperating agencies and stakeholders for review at their October 1st, 1998 meeting.
- Notices were published two times (Wednesday and Sunday) in the Idaho Statesman and the Idaho

World.

- Notices contained a draft document description, locations of available draft copies, directions for submitting written comments, IDEQ agency contacts, and notification of the public meeting to be held in Garden Valley, ID.
- A public meeting was held at the Garden Valley Senior Citizen Center, Garden Valley, Idaho on October 28, 1998 to present the main findings of the draft document and to answer questions from the community.

A total of nine written comments were received from interested agencies and stakeholders, including an extensive comments signed by 23 individuals living and working within the Middle Fork Payette Sub-basin. These comments were reviewed and discussed both internally and with the commenting party when possible.

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7. List of Abbreviations

BAG - Basin Advisory Group, §39-3601

cms- cubic meters per second

DEQ - Idaho Division of Environmental Quality

EPA - United States Environmental Protection Agency

ha - hectare

HUC - Hydrologic Unit Code

IDWR - Idaho Department of Water Resources

km - kilometer

km² - square kilometer

LA - Load Allocation, non-point source

m - meter

mg/L - milligram per liter

mi - mile

mL - milliliter

MOS - Margin of Safety

TMDL - Total Maximum Daily Load

t/y - tonnes per year

USDA - United States Department of Agriculture

USDI - United States Department of Interior

WAG - Watershed Advisory Group, §39-3601

WBID - Water Body Identification Number

WLA - Waste Load Allocation, point source

WQL - Water Quality Limited, Beneficial Uses not Fully Supported

§ - Section

§303(d) - section 303(d) of the Clean Water Act

°C - degrees Celsius

°F - degrees Fahrenheit

μg/L - microgram per liter

Appendix A: Middle Fork Payette River Subbasin Water Body Assessments

This appendix has been prepared to provide assessments and justification for the status of water bodies in the Middle Fork of the Payette River drainage. These assessments have been made by Boise Regional Office of Idaho Division of Environmental Quality. These assessments have been completed following the latest understanding of assessment methodology, and relies heavily on the assumptions and guidelines of the 1996 Water Body Assessment Guidance.

For each water body there is a table that provides the listing and assessment history. The notes include assessment logic and justification.

Water Body Identification	Description	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
ID-17050121-01	MF Payette - Anderson to mouth	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-02	Anderson Creek		Full Support	Full Support	Full Support	Full Support	
ID-17050121-03	MF Payette - Scriver to Anderson	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-04	MF Payette - Lightning to Scriver	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-05	Lightning Creek		Full Support	Full Support	Full Support	Full Support	
ID-17050121-06	MF Payette - Big Bulldog to Lightning	Full Support	Full Support	Not Full Support	Full Support	Full Support	Full Support
ID-17050121-07	Big Bulldog - Bulldog to mouth			Full Support	Full Support	Full Support	
ID-17050121-08	Big Bulldog - headwaters to Bulldog			Full Support		Full Support	
ID-17050121-09	Bulldog Creek			Full Support		Full Support	
ID-17050121-10	MF Payette - Rattlesnake to Big Bulldog	Full Support	Full Support	Full Support	Full Support	Full Support	Full Support
ID-17050121-11	Rattlesnake Creek			Full Support	Not Assessed	Full Support	
ID-17050121-12	MF Payette - Silver to Rattlesnake	Full Support	Full Support	Full Support	Full Support	Full Support	Full Support
ID-17050121-13	Silver - Peace to mouth			Full Support	Full Support	Full Support	
ID-17050121-14	Peace Creek			Full Support	Full Support	Full Support	
ID-17050121-15	Silver - headwaters to Peace			Full Support	Full Support	Full Support	
ID-17050121-16	MF Payette - Bull to Silver	Full Support	Full Support	Full Support	Full Support	Full Support	Full Support
ID-17050121-17	Bull Creek			Full Support	Full Support	Full Support	
ID-17050121-18	MF Payette - headwaters to Bull			Full Support	Full Support	Full Support	
ID-17050121-19	Scriver - MF Scriver to mouth			Full Support	Full Support	Full Support	
ID-17050121-20	Scriver - headwaters to MF Scriver			Full Support	Full Support	Full Support	
ID-17050121-21	MF Scriver Creek			Full Support	Full Support	Full Support	

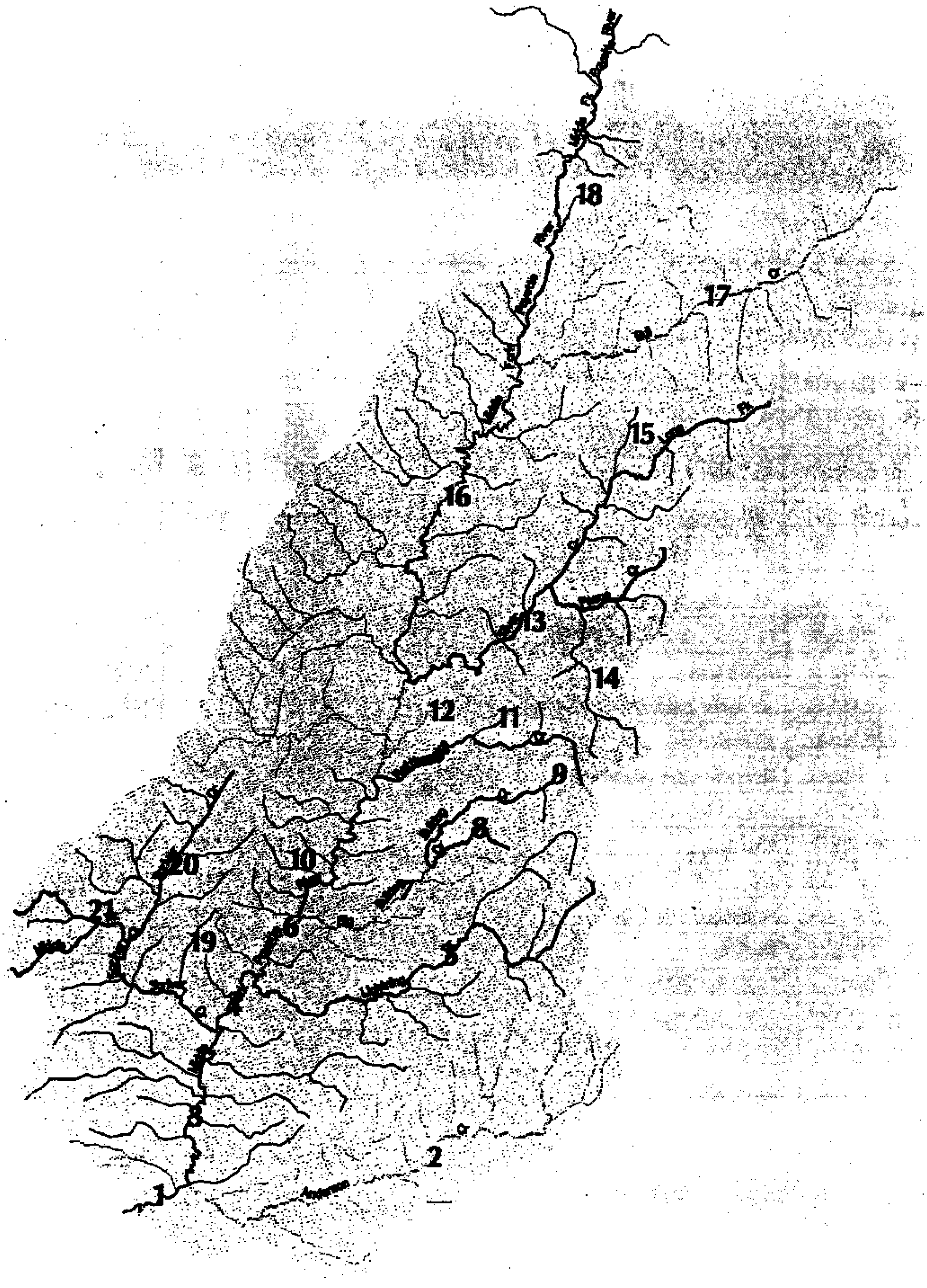

Figure 1 Middle Fork Payette Water Bodies

ID-17050121-01 **Middle Fork Payette River** upstream limit: Anderson Creek

PNRS: 703.00 downstream limit: South Fork Payette River

Current Classification in Idaho Water Quality Standards

map code: SWB-322 This water body is: Classified

Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-01 **Middle Fork Payette River** PNRS: 703.00 upstream limit: Anderson Creek downstream limit: South Fork Payette River

1998 Draft §305(b) and §303(d) Information

§303(d) listed: yes
cause: **sediment**

assessment info: DEQ '96 WBA

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: yes
cause: sediment

TMDL status: TMDL Developed 1998

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status	Full Support	Full Support	Not Full Support		Full Support	Full Support	Full Support

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-01:	yes	yes	yes	no	yes*	yes	no**

* limit to *P. williamsoni* ** secondary unnecessary when primary is designated

Notes: ID-17050121-01 Middle Fork Payette River

This water body includes the downstream most segment (river mile 0 to 2.5) of the Middle Fork Payette River, several unnamed ephemeral streams, and an unnamed perennial stream. The Middle Fork Payette River is a fourth order stream and classified as a C5 Rosgen stream type. The bed and banks are dominated by sand with occasional gravel and silt/clay. Air photos and recent flyover of the area show that the stream is channelized compared to historic conditions. The historic channel had higher sinuosity. There are still some abandoned meander ponds and traces of meander bends on the ground.

The lowland adjacent to this segment has been developed. The town of Crouch is located at the upper end of the segment. Most Crouch urban and municipal facilities acquire fresh water from wells and dispose of waste water with septic systems. Much of the low lying land immediately adjacent to the Middle Fork Payette is used as pasture or wetland sinks. Roads cross the Middle Fork Payette three times during the length of this water body. There are about 20 homes (Rivers Point Subdivision) along the river near the confluence with the South Fork Payette River.

This segment of the Middle Fork Payette River was first monitored by DEQ on August 20, 1997. One site (97SWIROB72) was established just upstream from the confluence with the South Fork Payette River. When requested, no other data was submitted by agencies for this assessment, specific to this water body. Additional investigations include *Middle Fork Payette River TMDL Sediment Trend Monitoring* (Fitzgerald et al. 2/9/98) and routine drinking water sampling for the Rivers Point Subdivision water system. A site was established this year at Davey's Bridge for the *Middle Fork Payette River TMDL Sediment Trend Monitoring* project. At this site we have begun measuring discharge, suspended sediment, turbidity, bed load, and developing a channel cross section.

Suckers, and to a lesser extent, whitefish, are the predominate large fish species currently utilizing this segment of the Middle Fork Payette River. This segment is appropriate for and utilized by three species of native salmonid fishes, mountain whitefish (*Prosopium williamsoni*), redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). While specific fishery monitoring data do not exist for this segment, information from similar, neighboring segments, and observation show that mountain whitefish propagate in, and year round inhabit water bodies of this type and condition. Redband trout (residualized steelhead), planted rainbow trout (*O. mykiss*) and bull trout are limited by lack of complexity to the habitat. Redband trout, and planted rainbow trout occasionally use this stream and would be more abundant, year round if habitat complexity and cover were increased. Redband/Rainbow trout have been observed using schools of suckers for cover. The most sensitive salmonid in the basin are bull trout. It is essential that bull trout be able to better utilize this segment for migration to the rest of the Payette bull trout populations. This segment is also critical to bull trout as overwintering habitat for adult and sub-adult fluvial (large stream migrating) bull trout. Bull Trout has been anecdotally observed utilizing one to the few pools near Crouch. Surveys are needed to better understand these and other non-game native fishes of the watershed.

Aquatic insects and other macroinvertebrates also inhabit this segment. DEQ's aquatic insect monitoring protocol calls for monitoring of aquatic insects in riffle habitat units. The insects collected in 1997 were collected for the run habitat. The 1997 samples were also collected from select portions of the streams that had gravel substrate. This was done to closest mimic what would be found in a riffle habitat if one existed. These samples are by no means definitive but they do give us a good idea of the condition of the aquatic insect community, and from that, the relative status of the water quality. The collected insects were of assemblages that generally indicate good water quality. The insects are also indicative of a depositional environment. Fresh water clams/mussels were abundant, which also indicate good water quality in a depositional environment.

The habitat in this segment is in a poor condition for fish. It is apparent that fine sediment (sand sized) inputs exceed stream carrying capacity much of the year. Lower portions of the stream have few if any pools, and the stream is becoming wider and shallower. Sand sized sediment dominate channel bed and banks. Gravel/boulder bars are seldom and are continuously covered by fine sediment after being exposed for short periods during low flow. Pools and to some extent riffles and glide habitats are missing. Fine sediment beds with thin veneers of water flowing over their top are predominant. The stream bed is dominated by sand ripples, dunes and antidune structures. The few existing pools are usually the result of hard structures that confine and accelerate water, like bridges, bank barbs, or tight radius meanders.

As far as it is known, this water body is free of water column pollutants, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The status of the microbiota, such as bacteria and other pathogens, is unknown and may need further investigation.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated from sampling this water body. The amount of bed load sediment in this segment do impair Cold Water Biota, and therefor exceed Idaho's narrative sediment criteria (IDAPA 16.01.02.200.08.)

There is a withdrawal of surface water at Rivers Point Subdivision from this segment, for domestic water supply. Rivers Point Subdivision water supply system has been operating since 1975 and has not reported any chronic raw water problems. All water supply and recreational beneficial uses have been "full support" for the last five years. Salmonid Spawning beneficial use is also "full support". The all but incidental spawning native salmonid is the mountain whitefish. Mountain whitefish are broadcast spawners and apparently successful in Middle Fork Payette river and neighboring streams. Redband trout spawning is unlikely and bull trout spawning is only going to occur much farther up in the watershed. Cold Water Biota beneficial use is impaired and is "Not Full Support". As discussed earlier, cold water biota, redband trout and bull trout, find habitat quality not sufficient to utilize the area. Their use of this segment is crucial to the long term survival of both species. Using §305(b) terminology the "cause" of the "Not Full Support" call for Cold Water Biota is excessive bed load sediment, and is compounded by a channelized stream. The "source" for excessive sediment is limited to non-point source activities. These activities include roads, bank failures, forest practices, agricultural practices, natural landslides and to a minor extent storm water management and direct dumping farther up in the watershed and along the tributaries.

It is important to note that loss of anadromous fish, introduction of non-native fishes, and nearby stocking of hatchery fish for a "put and take fishery" have greatly affected the complex interactions of the remaining native salmonids (*S. confluentus, O. mykiss,* and *P. williamsoni*). It is difficult to define or assure recovery, given these other population controlling issues.

ID-17050121-02 **Anderson Creek** upstream limit: **headwaters**

PNRS: 704.00 downstream limit: **Middle Fork Payette River**

Current Classification in Idaho Water Quality Standards

map code: **map codes not available for unclassified water bodies** This water body is: **Unclassified** Designated Special Resource Water: IDAPA 16.01.02.95: **no**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **not assessed in 1988**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info : **not assessed in 1992**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: **yes**
cause: **sediment**

assessment info: **no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: **yes**
cause: **sediment**

assessment info: **no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-02 **Anderson Creek** upstream limit: **headwaters**

PNRS: 704.00 downstream limit: **Middle Fork Payette River**

1998 Draft §305(b) and §303(d) Information

§303(d) listed: "**no**
cause: **delisting proposed**"

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: "**no**
cause: **delisting proposed**"

TMDL status: **No TMDL Planned**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status		**Full Support**	**Full Support**		**Full Support**	**Full Support**	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-02:	**no**	**yes**	**yes**	**no**	**yes***	**yes**	**no****

* limit to *O. mykiss* and *P. williamsoni* ** secondary unnecessary when primary is designated

Notes: ID-17050121-2 Anderson Creek

This water body includes Anderson Creek from its headwaters to the Middle Fork Payette River. There are several tributaries to the main stem of Anderson Creek, Brush Creek, Little Anderson Creek, Cow Creek, Burn Creek, Hailey Creek, Granite Creek and East Fork. Anderson Creek is a third order stream from the confluence with the Middle Fork Payette River to Little Anderson Creek and is generally classified as a B Rosgen stream type. The bed and banks are dominated by cobble followed by gravel, boulders and sand.

The lower three miles of Anderson Creek flows through private land, with some development. The watershed also includes forest service land in the headwaters and BLM land between the forest service and private land. The town of Crouch is located on the west side of the Middle Fork Payette River, across from the confluence with Anderson Creek. Drinking water for development in the area is supplied by wells, and wastewater disposal utilizes septic tanks. Some of the low lying land immediately adjacent to Anderson Creek is used as pasture or wetland sinks. Near the confluence with the Middle Fork Payette River, there is an arena. Forest Service Road 668 parallels Anderson Creek for almost its entire length and crosses once during the length of this water body. At this road crossing Anderson Creek is diverted for two major canals. A private road crosses Anderson Creek near the confluence and dead ends about one mile upstream on the north side.

Anderson Creek was first monitored by DEQ August 12, 1993. Four sites exist on Anderson Creek.

Site ID	Location		MBI	HI
93SWIRO18	forest service boundary		3.83	NA
96SWIROA76	100 yards downstream from Burn Creek	5.30	95	
96SWIROA77	bridge @ L. Anderson Creek confluence	4.50	95	
97SWIROB73	bridge @ L. Anderson Creek confluence	4.24	49	

The forest service also submitted baseline inventory information taken September 19, 1986. This inventory concludes that invertebrate production is poor, and the stream had very poor fish habitat due to excess fines. DEQ invertebrate and fish samples disagree with these conclusions. The fish population was surveyed during the BURP monitoring performed at 96SWIROA77 on August 6, 1996. The results were two age classes of rainbow trout (*O. mykiss*) (6 fish) and 33 Sculpin.

Two of the BURP sites, 97SWIROA77 and 97SWIROB73, and the BNF baseline inventory site were taken at the same spot. Habitat evaluations vary greatly. Both the 97SWIROB73 and the BNF baseline evaluations were following habitat degrading events. New years day 1997, rain on snow event occurred and in 1986 there were fires in the area. Both of these evaluations show excess sediment not found in the 1996 monitoring. Anderson Creek needs more intense, and trend monitoring to determine impairment due to habitat.

Sources (H. Malany and others, unconfirmed) tell that there used to be a significant brook trout fishery in the upper portions of Anderson Creek. On past timber sales, persons would hike all the way down the hill side to fish for, and catch, many brook trout. Current studies demonstrate that self proclaimed "good anglers" commonly mistake salmonids (Schill, 1998). Brook trout have not been found. Bull trout and rainbow may have been mistaken for brook trout.

Aquatic insects and other macroinvertebrates also inhabit this segment. These samples are by no means definitive but they do give us a good idea of the condition of the aquatic insect community, and from that, the relative status of the water quality. The collected insects were of assemblages that generally indicate good to excellent water quality.

The habitat in this stream is in questionable condition for fish. Cobble (64-256 mm) dominate channel bed and banks. Gravel/boulder bars are frequent. Pools make up about 25% of the stream with the remainder dominated by riffles.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Anderson Creek was impacted by the rain on snow event in January 1997. A considerable amount of sediment was delivered to the system and eventually to the Middle Fork Payette River. The stream gradient does not allow for significant deposition of fine sediment, however, the habitat score for the 1997 BURP monitoring indicate an impact to the riparian area. Due to a lack of development in the upper reaches of the stream, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, the previously mentioned BURP monitoring indicate this stream falls into the category of "full support" for cold water biota beneficial use. Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Agricultural Water Supply and Primary Contact Recreation appear to be in the "full support" category. With the absence of enough fish information a call of salmonid spawning status can not be made at this time.

ID-17050121-03 **Middle Fork Payette River** upstream limit: Scriver Creek

PNRS: 703.00 downstream limit: Anderson Creek

Current Classification in Idaho Water Quality Standards

map code: SWB-322 This water body is: Classified

Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-03 **Middle Fork Payette River** upstream limit: Scriver Creek
PNRS: 703.00 downstream limit: Anderson Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment
assessment info: DEQ '96 WBA

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: yes
cause: sediment
TMDL status: TMDL Developed 1998

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status	Full Support	Full Support	Not Full Support		Full Support	Full Support	Full Support

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-03:	no	yes	yes	no	yes*	yes	no**

* limit to *P. williamsoni* ** secondary unnecessary when primary is designated

Notes: ID-17050121-03 Middle Fork Payette River

This water body includes the segment of the Middle Fork Payette River from Anderson Creek to Scriver Creek. Gooseberry Creek, Little Gooseberry Creek, Warm Springs Creek, Smith Creek, Easley Creek and Pyle Creek are tributaries. The Middle Fork Payette River is a fourth order stream and classified as a C5 Rosgen stream type. The bed and banks are dominated by sand with occasional gravel and silt/clay. Air photos and recent flyover of the area show that the stream is channelized compared to historic conditions. The historic channel had higher sinuosity. There are still meander pools and traces of meander bends.

The lowland adjacent to this segment has been developed. The town of Crouch is located at the lower end of the segment. Most Crouch urban and municipal facilities acquire fresh water from wells and dispose of waste water with septic systems. Much of the low lying land immediately adjacent to the Middle Fork Payette is used as pasture or wetland sinks. Roads cross the Middle Fork Payette three times during the length of this water body.

This segment of the Middle Fork Payette River has not been formally monitored by DEQ. No other data was submitted by agencies when requested for data for this assessment, specific to this water body. Based on visual observations, it is estimated that the substrate consists of approximately 80% fines, with the remainder being pebble and cobble sized.

Suckers, and to a lesser extent, whitefish, are the predominate large fish species currently utilizing this segment of the Middle Fork Payette River. This segment is appropriate for and utilized by three species of native salmonid fishes, mountain whitefish (*Prosopium williamsoni*), redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). While specific fishery monitoring data do not exist for this segment, information from similar, neighboring segments, and observation show that mountain whitefish propagate in, and year round inhabit water bodies of this type and condition. Redband trout (residualized steelhead), planted rainbow trout (*O. mykiss*) and bull trout are limited by lack of complexity to the habitat. Redband trout, and planted rainbow trout occasionally use this stream and would be more abundant year round, if habitat complexity and cover were increased. Redband/Rainbow trout have been observed using schools of suckers for cover. The most sensitive salmonid in the basin are bull trout. It is essential that bull trout be able to better utilize this segment for migration to the rest of the Payette bull trout populations. This segment is also critical to bull trout as overwintering habitat for adult and sub-adult fluvial (large stream migrating) bull trout. Bull Trout has been anecdotally observed utilizing one to the few pools near Crouch. Surveys are needed to better understand these and other non-game native fishes of the watershed.

The habitat in this segment is in a poor condition for fish. No pools, greater than 2 meters in depth, have been observed during normal base flow conditions. Fine sediment inputs exceed carrying capacity much of the year. Fine sediment (≤6.35 mm) dominate channel bed and banks. Gravel/boulder bars are seldom and are continuously covered by fine sediment after being exposed for short periods during low flow. Pools and to some extent riffles and glide habitats are missing. Fine sediment beds with thin veneers of water flowing over their top are predominant. The few existing pools are usually the result of hard structures that confine and accelerate water, like bridges, bank barbs or tight radius meander bends.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The status of the microbiota, such as bacteria and other pathogens, is unknown and may need further investigation.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. The amount of bed load sediment in this segment do impair Cold Water Biota and therefor, exceed Idaho's narrative sediment criteria (IDAPA 16.01.02.200.08.)

All water supply and recreational beneficial uses have been "full support" for at least the last five years. Salmonid Spawning beneficial use is also "full support". The all but incidental spawning native salmonid is the mountain whitefish. Mountain whitefish are broadcast spawners and apparently successful in the Middle Fork Payette River or neighboring streams. Redband trout spawning is unlikely and bull trout spawning is only going to occur much further up in the watershed. Cold Water Biota beneficial use is impaired and is "Not Full Support". As discussed earlier cold water biota, redband trout and bull trout, find habitat quality not sufficient to utilize the area. Their use of this segment is crucial to the long term survival of both species. Using §305(b) terminology the "cause" of the "Not Full Support" call for Cold Water Biota is excessive bed load sediment, and is compounded by a channelized stream. The "source" for excessive sediment is limited to nonpoint source activities. These activities include roads, bank failures, forest practices, agricultural practices, natural landslides and to a minor extent storm water management and direct dumping farther up in the watershed and along the tributaries.

It is important to note that loss of anadromous fish, introduction of non-native fishes, and nearby stocking of hatchery fish for a "put and take fishery" have greatly affected the complex interactions of the remaining native salmonids (*S. confluentus, O. mykiss,* and *P. williamsoni*). It is difficult to define or assure recovery given these other population controlling issues.

ID-17050121-04 **Middle Fork Payette River** upstream limit: Lightning Creek

PNRS: 703.00 downstream limit: Scriver Creek

Current Classification in Idaho Water Quality Standards

map code: SWB-322 This water body is: Classified Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no assessment info: evaluated
cause:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no assessment info ; not assessed in 1992
cause:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.
cause: sediment

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.
cause: sediment

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-04 **Middle Fork Payette River** upstream limit: Lightning Creek
PNRS: 703.00 downstream limit: Scriver Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment
assessment info: DEQ '96 WBA

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: yes
cause: sediment
TMDL status: TMDL Developed 1998

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status	Full Support	Full Support	Not Full Support		Full Support	Full Support	Full Support

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-04:	no	yes	yes	no	yes*	yes	no**

* limit to *P. williamsoni* ** secondary unnecessary when primary is designated

Notes: ID-17050121-04 Middle Fork Payette River

This water body includes the segment of the Middle Fork Payette River from Scriver Creek to Lightning Creek. Koppes Creek is the only named tributary to this segment. The Middle Fork Payette River is a fourth order stream and classified as a C5 Rosgen stream type. The bed and banks are dominated by sand with occasional gravel and silt/clay. Air photos and recent flyover of the area show that the stream is channelized compared to historic conditions. The historic channel had higher sinuosity. There are still meander pools and traces of meander bends.

The lowland adjacent to this segment has been developed. The town of Crouch is located approximately five miles downstream from the confluence with Scriver Creek. Much of the low lying land immediately adjacent to the Middle Fork Payette is used as pasture or wetland sinks. Two small bridges cross the river in this segment.

This segment of the Middle Fork Payette River has not been monitored by DEQ. When requested, no other data was submitted by agencies for this assessment, specific to this water body. Additional investigations include *Middle Fork Payette River TMDL Sediment Trend Monitoring* (Fitzgerald et al. 2/9/98). A site was established this year at the Lightning Creek Bridge for the *Middle Fork Payette River TMDL Sediment Trend Monitoring* project. At this site we have begun measuring discharge, suspended sediment, turbidity, and bed load. Based on visual observations, it is estimated that the substrate consists of approximately 80% fines, with the remainder being cobble.

Suckers, and to a lesser extent, whitefish, are the predominate large fish species currently utilizing this segment of the Middle Fork Payette River. This segment is appropriate for and utilized by three species of native salmonid fishes, mountain whitefish (*Prosopium williamsoni*), redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). While specific fishery monitoring data do not exist for this segment, information from similar, neighboring segments, and observation show that mountain whitefish propagate in, and year round inhabit water bodies of this type and condition. Redband trout (residualized steelhead), planted rainbow trout (*O. mykiss*) and bull trout are limited by lack of complexity to the habitat. Redband trout, and planted rainbow trout occasionally use this stream and would be more abundant, year round, if habitat complexity and cover were increased. Redband/Rainbow trout have been observed using schools of suckers for cover. The most sensitive salmonid in the basin are bull trout. It is essential that bull trout be able to better utilize this segment for migration to the rest of the Payette bull trout populations. This segment is also critical to bull trout as overwintering habitat for adult and sub-adult fluvial (large stream migrating) bull trout. Bull Trout has been anecdotally observed utilizing one to the few pools near Crouch. Surveys are needed to better understand these and other non-game native fishes of the watershed.

The habitat in this segment is in a poor condition for fish. Fine sediment inputs exceed carrying capacity much of the year. Fine sediment (≤6.35 mm) dominate channel bed and banks. Gravel/boulder bars are seldom and are continuously covered by fine sediment after being exposed for short periods during low flow. Pools and to some extent riffles and glide habitats are missing. Fine sediment beds with thin veneers of water flowing over their top are predominant. The few existing pools are usually the result of hard structures that confine and accelerate water, like bridges, bank barbs, and tight radius meander bends.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Another area of potential concern that may require further investigation is the bacteria and associated pathogens concern. Pasture run off and septic failure may occur, and become a health risk for contact recreation and the downstream water supplies.

<u>Numeric</u> criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. The amount of bed load sediment in this segment do impair Cold Water Biota though, and therefor exceed Idaho's <u>narrative</u> sediment criteria (IDAPA 16.01.02.200.08.)

All water supply and recreational beneficial uses have been "full support" for the last five years. Salmonid Spawning beneficial use is also "full support". The all but incidental spawning native salmonid is the mountain whitefish. Mountain whitefish are broadcast spawners and apparently successful in the Middle Fork Payette River or neighboring streams. Redband trout spawning is unlikely and bull trout spawning is only going to occur much further up in the watershed. Cold Water Biota beneficial use is impaired and is "Not Full Support". As discussed earlier, cold water biota, redband trout and bull trout, find habitat quality not sufficient to utilize the area. Their use of this segment is crucial to the long term survival of both species. Using §305(b) terminology the "cause" of the "Not Full Support" call for Cold Water Biota is excessive bed load sediment, and is compounded by a channelized stream. The "source" for excessive sediment is limited to nonpoint source activities. These activities include roads, bank failures, forest practices, agricultural practices, natural landslides and to a minor extent, storm water management and direct dumping.

It is important to note that loss of anadromous fish, introduction of non-native fishes, and nearby stocking of hatchery fish for a "put and take fishery" have greatly affected the complex interactions of the remaining native salmonids. It is difficult to define or assure recovery given these other population controlling issues. The fish in this segment have also had high predation by fish eating mergansers and river otters.

ID-17050121-05 **Lightning Creek** upstream limit: headwaters
PNRS: none downstream limit: Middle Fork Payette River

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: Unclassified

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-05	Lightning Creek	upstream limit: **headwaters**
	PNRS: none	downstream limit: Middle Fork Payette River

1998 Draft §305(b) and §303(d) Information

§303(d) listed: "no cause: delisting proposed"

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: "no cause: delisting proposed"

TMDL status: No TMDL planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status		Full Support	Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-05:	no	yes	yes	no	yes*	yes	no**

* limit to *O. mykiss* ** secondary unnecessary when primary is designated

Notes: ID-17050121-5 Lightning Creek

This water body includes Lightning Creek from its headwaters to the Middle Fork Payette River. Tributaries include Onion Creek and several other small unnamed tributaries. At its confluence with the Middle Fork Payette River, Lightning Creek is a third order stream and is a B Rosgen stream type. It is an "A" type stream further up in the watershed as the terrain steepens. The bed and banks are dominated by gravel but also include boulders, cobble and sand.

The Lightning Creek watershed lies almost entirely on forest service land. It flows through private land just at the confluence with the Middle Fork Payette River. The town of Crouch is located approximately eight miles downstream from the confluence with the Middle Fork Payette River. There is also an irrigation diversion approximately ½ mile upstream from the confluence. Forest Service Road 611 lies within the lower Lightning Creek watershed and dead ends approximately eight road miles (four river miles) upstream from the confluence.

Lightning Creek has not been monitored by DEQ prior to the BURP monitoring July 11, 1996. Four sites exist on Lightning Creek.

Site ID	Location	MBI	HI
96SWIROB48	Lightning Creek bridge	4.64	107
97SWIROA71	just upstream from MFPR confluence	5.00	65
1998SBOIA76	0.7 mile from intersection of FR611 and FR698	NA	84*
1998SBOIA77	miles from intersection of FR611 + FR698	NA	117*

* = interim value, hand calculated, has not gone through review.
NA = macroinvertebrate lab analysis not available as of September 2, 1998

The MBI is a measure of aquatic insects and other macroinvertebrates. These samples are by no means definitive, but do give a good idea of the condition of the aquatic insect community, and from that, the relative status of the water quality. The collected insects were of assemblages that generally indicate good water quality. Habitat scores are developed following the habitat assessment process cited in Hayslip 1993. The three samples, 96SWIROB48, 97SWIROA71, and 1998SBOIA76 are located in relatively the same spot, within 0.5 miles of the confluence with Middle Fork Payette River. The 1996 habitat assessment score falls into the category of "full support". In between the 1996 and 1997 monitoring, the "New Years Day Flood" of 1997 occurred. The climatic event was manifested in this watershed as a significant rain on snow event. Many natural and man caused land slides occurred up in the watershed. The 1997 monitoring was conducted on the upper end of a delta like formation of transported fine sediment. The 1998 monitoring and observation suggest that this area may be in a state of recovery.

The habitat in this stream is in fair condition for fish. Gravel and boulders dominate channel bed and banks. Pools are not frequent, making up less than 5% of the stream, with the remainder dominated by riffles, runs and glides. Upper Lightning Creek is also considered to be "adjunct" habitat for Bull Trout. This would indicate that the elevation and watershed size is adequate for spawning and rearing in the upper watershed including Onion Creek, however, whether bull trout have ever used it for these purposes is unknown.

Boise National Forest Aquatic Survey:
Mile 0.0, 5 Sculpin, 5 Sucker
Mile 2.5, 64 Rainbow Trout (lengths unknown)
Mile 3.5, 51 Rainbow Trout (lengths unknown)

The lengths of the rainbow trout are unknown, but are in relatively abundant numbers. More fishery data would be of assistance, but this abundance suggests that rainbow trout are successfully reproducing (salmonid spawning).

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Lightning Creek was impacted by the rain on snow event in January 1997. A considerable amount of sediment was delivered to the system and eventually to the Middle Fork Payette River. The stream gradient does not allow for significant deposition of fine sediment, however, the habitat score for the 1997 BURP monitoring indicate an impact to the riparian area. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols and this assessment, the previously mentioned monitoring indicate this stream fully supports cold water biota, and salmonid spawning as a beneficial uses. Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Agricultural Water Supply and Primary Contact Recreation are in the "full support" category as well.

ID-17050121-06 **Middle Fork Payette River** upstream limit: Big Bulldog Creek
PNRS: 703.00 downstream limit: Lightning Creek

Current Classification in Idaho Water Quality Standards

map code: SWB-322 This water body is: Classified Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:
assessment info: evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:
assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment
assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment
assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-06 **Middle Fork Payette River** upstream limit: **Big Bulldog Creek**

PNRS: 703.00 downstream limit: **Lightning Creek**

1998 Draft §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: DEQ '96 WBA

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: yes
cause: sediment

TMDL status: TMDL developed 1998 - TMDL from 0.5 miles downstream from Big Bulldog Creek to Lightning Creek.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status	Full Support	Full Support	Not Full Support		Full Support	Full Support	Full Support

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-06	no	yes	yes	no	yes*	yes	no**

* limit to *P. williamsoni* ** secondary unnecessary when primary is designated

Notes: ID-17050121-06 Middle Fork Payette River

This water body includes the segment of the Middle Fork Payette River from Lightening Creek to Big Bulldog Creek. Auglebright Gulch, Skid Road Creek and Tie Creek are tributaries to this segment. The Middle Fork Payette River is a fourth order stream and classified as a C5 Rosgen stream type. The majority of the bed and banks are dominated by sand with occasional gravel and silt/clay. Air photos and recent flyover of the area show that portions of the stream are channelized compared to historic conditions. There are still meander pools and traces of meander bends. Approximately 0.5 miles down stream this segment from Big Bulldog Creek changes from a sediment transport reach to a sediment depositional reach. The upper section (transport) is boulder pool dominated. This upper section is not represented by the following description.

The lowland adjacent to this segment has been developed. The town of Crouch is located approximately eight miles downstream from the confluence with Lightening Creek. Much of the low lying land immediately adjacent to the Middle Fork Payette is used as pasture or yard. The bridge for forest road 611 crosses the river in this segment.

This segment of the Middle Fork Payette River was first monitored by DEQ on July 20, 1994. Two BURP sites exist in this segment. These sites exist at the uppermost portion of this segment in the sediment transport reach.

Site ID	Location	MBI	HI
94SWIROA44	upstream from Tie Creek CG	2.61	86
95SWIROC28	@ Tie Creek CG	4.55	83

The fish population has been surveyed by the Boise National Forest using their aquatic survey protocol. The results were no salmonids and 29 suckers. In 1978 Lyle Burmeister and Don Corley observed 2 Dolly Varden that were 14 inches or longer at their Tie Creek site. These Dolly Varden have had their common name changed from "Dolly Varden" to "Bull Trout", in any case Lyle and Don had observed fluvial bull trout near Tie Creek back in 1978.

Additional investigations include *Middle Fork Payette River TMDL Sediment Trend Monitoring* (Fitzgerald et al. 2/9/98). A site was established this year at the Lightning Creek Bridge for the *Middle Fork Payette River TMDL Sediment Trend Monitoring* project. At this site we have begun measuring discharge, suspended sediment, turbidity, and bed load. Based on visual observations, it is estimated that the substrate consists of approximately 80% fines, with the remainder being cobble.

Suckers, and to a lesser extent, whitefish, are the predominate large fish species currently utilizing this segment of the Middle Fork Payette River. This segment is appropriate for and utilized by three species of native salmonid fishes, mountain whitefish (*Prosopium williamsoni*), redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). While specific fishery monitoring data do not exist for this segment, information from similar, neighboring segments, and observation show that mountain whitefish propagate in, and year round inhabit water bodies of this type and condition. Redband trout (residualized steelhead), planted rainbow trout (*O. mykiss*) and bull trout are limited by lack of complexity to the habitat. Redband trout, and planted rainbow trout occasionally use this stream and would be more abundant, year round, if habitat complexity and cover were increased. Redband/Rainbow trout have been observed using schools of suckers for cover. The most sensitive salmonid in the basin are bull trout. It is essential that bull trout be able to better utilize this segment for migration to the rest of the Payette bull trout populations. This segment is also critical to bull trout as overwintering habitat for adult and sub-adult fluvial (large stream migrating) bull trout. Surveys are needed to better understand these and other non-game native fishes of the watershed.

The habitat in this segment is in a poor condition for fish. Fine sediment inputs exceed carrying capacity much of the year. Fine sediment dominate channel bed and banks. Gravel/boulder bars are seldom and are continuously covered by fine sediment after being exposed for short periods during low flow. Pools and to some extent riffles and glide habitats are missing. Fine sediment beds with thin veneers of water flowing over their top are predominant. The few existing pools are usually the result of hard structures that confine and accelerate water, like bridges.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Another area of potential concern that may require further investigation is the bacteria and associated pathogens concern. Pasture and yard run off and septic failure may occur, and become a health risk for contact recreation and the downstream water supplies.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. The amount of bed load sediment in this segment do impair Cold Water Biota though, and therefor exceed Idaho's narrative sediment criteria (IDAPA 16.01.02.200.08.)

All water supply and recreational beneficial uses have been "full support" for the last five years. Salmonid Spawning (*P. williamsoni*) beneficial use is also "full support". The all but incidental spawning salmonid native is the mountain whitefish. Mountain whitefish are broadcast spawners and apparently successful in the Middle Fork Payette River or neighboring streams. Redband trout spawning is unlikely and bull trout spawning is only going to occur much further up in the watershed. Cold Water Biota beneficial use is impaired and is "Not Full Support". As discussed earlier, cold water biota, redband trout and bull trout, find habitat quality not sufficient to utilize the area. Their use of this segment is crucial to the long term survival of both species. Using §305(b) terminology the "cause" of the "Not Full Support" call for Cold Water Biota is excessive bed load sediment, and is compounded by a channelized stream. The "source" for excessive sediment is limited to nonpoint source activities. These activities include roads, bank failures, forest practices, agricultural practices, natural landslides and to a minor extent storm water management and direct dumping.

It is important to note that loss of anadromous fish, introduction of non-native fishes, and nearby stocking of hatchery fish for a "put and take fishery" have greatly affected the complex interactions of the remaining native salmonids. It is difficult to define or assure recovery given these other population controlling issues. The fish in this segment have also had high predation by fish eating mergansers and river otters.

ID-17050121-07 **Big Bulldog Creek** upstream limit: Bulldog Creek

PNRS: none downstream limit: Middle Fork Payette River

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: Unclassified

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1994.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assesed in 1996.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-07	Big Bulldog Creek	upstream limit: Bulldog Creek
	PNRS: none	downstream limit: Middle Fork Payette River

1998 Draft §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: no
cause:

TMDL status: No TMDL planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-07:	no	no	yes	no	yes*	yes	no**

* limit to *O. mykiss* ** secondary unnecessary when primary is designated

Notes: ID-17050121-7 Big Bulldog Creek

This water body includes Big Bulldog Creek from its headwaters to the Middle Fork Payette River. Tributaries include Little Bulldog Creek (to the south) and several other small unnamed tributaries. Big Bulldog Creek is a third order stream from the confluence with the Middle Fork Payette River to its confluence with Bulldog Creek and is classified as a B Rosgen stream type. The bed and banks are dominated by gravel followed by boulders, cobble and sand.

The Big Bulldog Creek watershed lies entirely within forest service land. The town of Crouch is located approximately eleven miles downstream from the confluence with the Middle Fork Payette River. Forest Service Road 611G dead ends approximately 1/4 mile from Big Bulldog Creek. No other roads exist in the watershed.

Big Bulldog Creek was first monitored by DEQ following BURP monitoring August 11, 1993. One site exists on Big Bulldog Creek.

Site ID	Location	MBI	HI
93SWIRO22	just upstream from MFPR confluence	4.94	NA

The forest service also submitted Baseline Inventory information of Big Bulldog Creek taken September 16, 1986. They found: Small, shallow stream with a 2-3% gradient. Pool-riffle ratio is 1:8 with 3rd class pools. The substrate is 30% sand, 10% gravel, 30-35% cobble, 20% boulder and 10% bedrock. Food production is low. The sandy substrate and embeddedness is detrimental to food production, juvenile cove, winter dormancy habitat, and spawning success. DEQ evaluation of macroinvertebrate condition conflicts with above observation.

Boise National Forest Aquatic Survey Results:

- Mile 0.0, 3/0-4in Rainbow Trout, 7 Sculpin, 12 Sucker
- Mile 1.0, 1/0-4in 7/4-8in Rainbow Trout
- Mile 2.5, 1/0-4in 5/4-8in Rainbow Trout
- Mile 3.5, no fish

Mile 4.5, no fish

The above MBI value is a measure of aquatic insects and other macroinvertebrates. These samples are by no means definitive but they do give us a good idea of the condition of the aquatic insect community, and from that the relative status of the water quality. The collected insects were of assemblages that generally indicate good water quality.

Although no information exists, the habitat in this stream should be in good condition for fish. Habitat measures taken in 1993 indicate embeddedness, percent fines, canopy, width to depth ratio and pool to riffle ratio are all in good condition.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols and observation, the monitoring indicate that this segment falls into the "full support" status category for cold water biota beneficial use. Salmonid spawning is occurring, and is in the "full support" category. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation are in the "full support" category as well, even though access is not likely.

ID-17050121-08 **Big Bulldog Creek** upstream limit: headwaters

PNRS: none downstream limit: Bulldog Creek

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: **Unclassified**

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1994.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1996.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-08	**Big Bulldog Creek**	upstream limit: **headwaters**
	PNRS: none	downstream limit: **Bulldog Creek**

1998 Draft §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: no
cause: -

TMDL status: No TMDL planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support			Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-08:	no	no	yes	no	no	no	yes

Notes: ID-17050121-8 Big Bulldog Creek

This water body includes Big Bulldog Creek from its confluence with Bulldog creek to it's headwaters. Tributaries include several small unnamed tributaries. Big Bulldog Creek is a second order stream at the confluence with the Bulldog Creek and is classified as a B Rosgen stream type. The bed and banks are dominated by gravel followed by boulders, cobble and sand.

The Big Bulldog Creek watershed lies entirely within forest service land. The town of Crouch is located approximately eleven miles downstream from the confluence with the Middle Fork Payette River. Forest Service Road 611G dead ends approximately 1/4 mile from Big Bulldog Creek. No other roads exist in the watershed.

Big Bulldog Creek has not been monitored by DEQ following BURP monitoring.

Boise National Forest Aquatic Survey Results:
Mile 5.5, no fish

Although no information exists, the habitat in this stream should be in good condition due it's remoteness and the difficulty to access.

As far as it is known, this water body is free of water column contamination. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols and observation, the monitoring indicate that this segment falls into the "full support" status category for cold water biota beneficial use. There is no evidence that Salmonid spawning is occurring, and therefore not assessed. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation is in the "full support" category as well, even though access is not likely.

ID-17050121-09 **Bulldog Creek** upstream limit: headwaters

PNRS: none downstream limit: Big Bulldog Creek

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: Unclassified

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-09	Bulldog Creek	upstream limit: headwaters
	PNRS: none	downstream limit: Big Bulldog Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: "no
cause: delisting proposed"

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: "no
cause: delisting proposed"

TMDL status: No TMDL Planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support			Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-09:	no	no	yes	no	no	no	yes

Notes: ID 17050121-9 Bulldog Creek

This water body includes Bulldog Creek from its headwaters to the Big Bulldog Creek. Tributaries include several other small unnamed tributaries. Bulldog Creek is a second order stream at it's the confluence with the Big Bulldog Creek and is presumed to classified as a B Rosgen stream type.

The Big Bulldog Creek watershed lies entirely within forest service land. The town of Crouch is located approximately eleven miles downstream from the confluence with the Middle Fork Payette River. Forest Service Road 611G dead ends approximately 1/4 mile from Big Bulldog Creek. No other roads exist in the watershed.

DEQ crews were sent to monitor Bulldog Creek August of 1997. The crew hiked for nine hours on hill slope prior to abandoning effort. Bulldog creek is inaccessible, and therefore not likely to be impaired beyond natural conditions.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on judgement that without any activities and limited access, this segment falls into the "full support" status category for cold water biota beneficial use. There is no evidence that Salmonid spawning is occurring, and therefore not assessed. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation is in the "full support" category as well, even though access is not likely.

ID-17050121-10 **Middle Fork Payette River** upstream limit: **Rattlesnake Creek**

PNRS: 703.00 downstream limit: **Big Bulldog Creek**

Current Classification in Idaho Water Quality Standards

map code: SWB-322 This water body is: Classified

Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-10 **Middle Fork Payette River** upstream limit: Rattlesnake Creek

PNRS: 703.00 downstream limit: Big Bulldog Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: DEQ '96 WBA

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: yes
cause: sediment

TMDL status: No TMDL planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-10:	no	no	yes	no	yes*	yes	no**

* limit to *P. williamsoni, O. mykiss* ** secondary unnecessary when primary is designated

Notes: ID-17050121-10 Middle Fork Payette River

This water body includes the segment of the Middle Fork Payette River from Big Bulldog Creek to Rattlesnake Creek. Powderhouse Gulch, Boom Creek, Bell Creek and Rocky Canyon are tributaries to this segment. The Middle Fork Payette River is a fourth order stream and classified as a C5 Rosgen stream type. The bed and banks are dominated by sand with occasional gravel and silt/clay. This segment marks the beginning of canyon morphology for the Middle Fork Payette River.

This segment of the Middle Fork Payette River lies entirely within the Boise National Forest. The town of Crouch is located approximately 11 miles downstream from the confluence with the Big Bulldog Creek. Hardscrabble and Rattlesnake forest campgrounds are located along this segment of the river. Forest service road 698 parallels and crosses the river once near Hardscrabble campground. There are no other roads located near the Middle Fork Payette in this segment.

This segment of the Middle Fork Payette River was first monitored by DEQ following BURP on August 21, 1997. One site exists in this segment. The site was picked in a depositional stretch above some rapids, and is atypical of this segment. Habitat score is low but is representative of a very small portion of the waterbody.

Site ID	Location	MBI	HI
97SWIROA74	just downstream from Rocky Canyon	3.81	54

The fish population has been surveyed by the Boise National Forest (1993) using their aquatic survey database. The results were a reduced rainbow trout population with suckers as the predominant species. Additional surveys by the Department of Fish & Game on July 25, 1996 found the following:

Location	Hatchery RBT	Wild RBT	Mtn Whitefish	Speckled Dace

2.3 miles u.s. from Tie Creek CG	1	0	29	0
2.5 miles u.s. from Tie Creek CG	0	3	23	0
4.7 miles u.s. from Tie Creek CG	1	18	70	1

BURP monitoring found the stream bed to be predominantly sand followed by gravel and some boulders.

This segment of the Middle Fork Payette River is currently appropriate for and utilized by three species of native salmonid fishes, mountain whitefish (*Prosoptum williamsoni*), redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). Mountain whitefish is the predominate utilization species for this segment. This segment is also critical to bull trout as overwintering habitat for adult and sub-adult fluvial (large stream migrating) bull trout.

The habitat in the transport sections of this segment is in a fair condition for fish. In the depositional sections (few) fine sediment inputs exceed carrying capacity much of the year. Pools and to some extent riffles and glide habitats are missing.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, considering the number and age classes of fish found in the IDFG survey, the amount of bed load sediment in this segment does not appear to impair Cold Water Biota as a beneficial use.

All water supply and recreational beneficial uses have been "full support" for the last five years. Salmonid Spawning beneficial use is also "full support". Both native mountain whitefish and redband trout spawn in this section. Both Mountain whitefish (broadcast spawners) and Redband Trout (redd builders) are successful in this section of the Middle Fork Payette River or neighboring streams. Bull trout spawning is only going to occur much further up in the watershed.

It is important to note that loss of anadromous fish, introduction of non-native fishes, and nearby stocking of hatchery fish for a "put and take fishery" have greatly affected the complex interactions of the remaining native salmonids. It is difficult to define or assure recovery given these other population controlling issues.

ID-17050121-11 **Rattlesnake Creek** upstream limit: **headwaters**
PNRS: **none** downstream limit: **Middle Fork Payette River**

Current Classification in Idaho Water Quality Standards

map code: **map codes not available for unclassified water bodies**

This water body is: **Unclassified**

Designated Special Resource Water: IDAPA 16.01.02.95: **no**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **not assessed in 1988**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info : **not assessed in 1992**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **no water bodies assessed in 1994.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **no water bodies assessed in 1996.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-11 **Rattlesnake Creek** upstream limit: headwaters

PNRS: none downstream limit: Middle Fork Payette River

1998 Draft §305(b) and §303(d) Information

§303(d) listed: no assessment info:
cause:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: no TMDL status: No TMDL planned
cause:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Not Assessed	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-11:	no	no	yes	no	yes*	yes	no**

* limit to *O. mykiss* ** secondary unnecessary when primary is designated

Notes: ID-17050121-11 Rattlesnake Creek

This water body includes Rattlesnake Creek from its headwaters to the Middle Fork Payette River. There are several unnamed tributaries to the main stem of Rattlesnake Creek. Rattlesnake Creek is a third order stream near it's confluence with the Middle Fork Payette River and is classified as a B Rosgen stream type. The bed and banks are dominated by cobble followed by gravel, boulders and sand.

Rattlesnake Creek lies entirely within the Boise National Forest. The town of Crouch is located approximately 17 miles downstream from the confluence with the Middle Fork Payette River. Rattlesnake forest campground is located at the mouth of the creek. There are no roads located in the watershed.

Rattlesnake Creek has not been monitored by DEQ.

The Boise National Forest Land and Resource Management Plan gives Rattlesnake Creek a Class 3 Riparian Value Class. This indicates "locally significant resource values, local sport fishery and provides a typical recreation setting or experience."

As far as it is known, this water body is free of water column contamination. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, observation, and judgement this segment fall into the "full support" status category for cold water biota beneficial use. Salmonid spawning is most likely occurring, but without data has not been assessed. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation are in the "full support" category as well, even though access is limited.

ID-17050121-12 | Middle Fork Payette River | upstream limit: Silver Creek
PNRS: 703.00 | downstream limit: Rattlesnake Creek

Current Classification in Idaho Water Quality Standards

map code: SWB-322 | This water body is: Classified | Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-12	Middle Fork Payette River	upstream limit: Silver Creek
	PNRS: 703.00	downstream limit: Rattlesnake Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: DEQ '96 WBA

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: yes
cause: sediment

TMDL status: No TMDL planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status	**Full Support**	**Full Support**	**Full Support**		**Full Support**	**Full Support**	**Full Support**

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-12:	no	yes	yes	no	yes*	yes	no**

* limit to *P. williamsoni* and *O. mykiss* ** secondary unnecessary when primary is designated

Notes: ID-17050121-12 Middle Fork Payette River

This water body includes the segment of the Middle Fork Payette River from Rattlesnake Creek to Silver Creek. Trail Creek and Six-Mile Creek are also tributaries included in this waterbody. The Middle Fork Payette River is a fourth order stream and classified as a C2 Rosgen stream type. The bed and banks are dominated by boulder with occasional gravel and sand. This segment is a continuation of canyon morphology for the Middle Fork Payette River.

This segment of the Middle Fork Payette River lies entirely within the Boise National Forest. The town of Crouch is located approximately 17 miles downstream from the confluence with the Rattlesnake Creek. Trail Creek forest campground is located along this segment of the river. Forest service road 698 parallels the river and forest service road 670 forms a "T" across the Middle Fork Payette River from Silver Creek. Forest road 671 begins at the mouth of Trail Creek.

This segment of the Middle Fork Payette River was first monitored by DEQ on July 20, 1994. Two sites exist in this segment.

Site ID	Location		MBI	HI
94SWIROA43	just upstream from Rattlesnake CG		4.99	72
95SWIROC27	0.9 miles above Rattlesnake CG	3.85	90	

The fish population has been surveyed by the Boise National Forest (1993) using their aquatic survey database. The results were as follows: Mile 19.5, 1/4-8in Rainbow Trout, 1/0-4in 1/4-8in Whitefish; Mile 20.5, 1/0-4in Rainbow Trout, 1/0-4in Whitefish.

BURP monitoring found the stream bed to be predominantly cobble followed by small boulders and sand.

This segment of the Middle Fork Payette River is currently appropriate for and utilized by three species of native salmonid fishes, Whitefish (*P. williamsoni*), redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). Redband trout use this stream and may be more abundant, year round, if habitat complexity increased. It is essential that Bull trout be able to better utilize this segment for migration to the rest of the Payette bull trout populations. This segment may also be critical to bull trout as overwintering habitat for adult and sub-adult fluvial (large stream migrating) bull trout.

Based on the BURP monitoring, the habitat in this segment is in a fair condition for fish. Riffle habitat dominates this segment of the river, followed by runs and glides. Pools are minor or missing.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. Both macroinvertebrate and one of the habitat values show non impairment, based on current assessment protocols. Considering the number and age classes of fish found in the BNF survey, the amount of bed load sediment in this segment does not appear to impair Cold Water Biota as a beneficial use.

All water supply and recreational beneficial uses have been "full support" for the last five years. Salmonid Spawning beneficial use is also "full support". Both native mountain whitefish and redband trout spawn in this section. Both Mountain whitefish (broadcast spawners) and Redband Trout (redd builders) are successful in this section of the Middle Fork Payette River or neighboring streams. Bull trout spawning is only going to occur further up in the watershed.

It is important to note that loss of anadromous fish, introduction of non-native fishes, and nearby stocking of hatchery fish for a "put and take fishery" have greatly affected the complex interactions of the remaining native salmonids. It is difficult to define or assure recovery given these other population controlling issues.

ID-17050121-13 **Silver Creek** upstream limit: Peace Creek
PNRS: none downstream limit: Middle Fork Payette River

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: Unclassified

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1994.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1996.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-13 **Silver Creek** upstream limit: Peace Creek

PNRS: none downstream limit: Middle Fork Payette River

1998 Draft §305(b) and §303(d) Information

§303(d) listed: "no assessment info:
cause: delisting proposed"

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: "no TMDL status: No TMDL planned
cause: delisting proposed"

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-13:	no	no	yes	no	yes*	yes	no**

* limit to *O. mykiss and S. confluentus* ** secondary unnecessary when primary is designated

Notes: ID-17050121-13 Silver Creek

This water body includes Silver Creek from its confluence with the Middle Fork Payette River to the confluence with Peace Creek. There are several unnamed tributaries to the main stem of Silver Creek. Silver Creek is a third order stream from the confluence with the Middle Fork Payette River to its headwaters and is classified as a B3 Rosgen stream type. The channel bed is dominated by cobble sized materials and characterized by a series of rapids with irregularly spaced scour pads.

The Silver Creek watershed lies almost entirely within forest service land. Silver Creek Plunge, a privately owned recreation area, is located on a section of state land (T12N, R4E, Section 36) on Silver Creek approximately one mile downstream from the confluence with Peace Creek. The town of Crouch is located approximately twenty miles downstream from the confluence with the Middle Fork Payette River. Forest Service Road 671 enters this watershed approximately one mile east of the confluence with the Middle Fork Payette River. This road crosses (and begins to parallel) Silver Creek approximately two miles downstream from the confluence with Peace Creek.

Lower Silver Creek was first monitored by DEQ following BURP monitoring process August 20, 1997.

Site ID	Location	MBI	HI
97SWIROA72	@ the mouth	5.25	82

The fish population was surveyed on July 24, 1996 by the Department of Fish & Game. The results were two age classes of wild rainbow trout (17 fish) and 7 Brook Trout.

Boise National Forest Aquatic Surveys have found:
1993, Mile 6, 4/0-4in 1/8-12in Rainbow Trout, 3/0-4in 1/4-8in Brook Trout
1994, Mile 0, 3/0-4in 1/8-12in Rainbow Trout, 1/4-8in Whitefish
1994, Mile 3, 3/0-4in 1/8-12in Rainbow Trout, 2/4-8in Brook Trout
1994, Mile 4, 3/0-4in 1/8-12in Rainbow Trout, 1/0-4in 1/4-8in Brook Trout

Aquatic insects and other macroinvertebrates also inhabit this segment. The sample is by no means definitive but it does give us a good idea of the condition of the aquatic insect community, and from that the relative status of the water quality. The collected insects were of an assemblage that generally indicates good water quality.

The habitat in this stream is in fair condition for fish. Cobble (64-256 mm) dominate channel bed and banks. Gravel/boulder bars are frequent. This transect was dominated by riffles, and no pools were found during this BURP monitoring. Following the BURP monitoring process a pool *isn't counted unless it is at least half of the stream width. Silver Creek in this section is made up of many smaller pocket/boulder pools.* Habitat is available and looks good, even though it doesn't show up in the DEQ habitat score. Streambanks were in stable condition.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment, and the habitat score for the 1997 BURP monitoring indicate a riparian area in fair condition. Due to a lack of development in the upper reaches of the stream, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, observation, and judgement, this segment fall into the "full support" status category for cold water biota beneficial use. Salmonid spawning is occurring and is also in the "full support" status category. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation are in the "full support" category as well.

ID-17050121-14 | Peace Creek | upstream limit: headwaters

PNRS: none | downstream limit: Silver Creek

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: Unclassified

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1994.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1996.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-14	Peace Creek	upstream limit: headwaters
	PNRS: none	downstream limit: Silver Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: no
cause:

TMDL status: No TMDL Planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-14:	no	yes	yes	no	yes*	yes	no**

* limit to *O. mykiss* and *S. confluentus* ** secondary unnecessary when primary is designated

Notes: ID-17050121-14 Peace Creek

This water body includes Peace Creek from its headwaters to the confluence with Silver Creek. Valley Creek is a tributary to the main stem of Peace Creek along with several unnamed tributaries. Peace Creek is a third order stream from the confluence with Silver Creek to its headwaters and is classified as a B3 Rosgen stream type near it's mouth.

The Peace Creek watershed lies entirely within forest service land. There are no roads in the watershed.

Peace Creek has not been monitored by DEQ. The following is the fish data provided by Boise National Forest:

ID	DATE	A	B	C	D	E	F
94PEC0	na	5	9	1	7	11	1
94PEC1	na	5	6	0	2	7	0
94PEC2	na	0	0	0	0	8	0
94PEC3	na	4	0	0	0	0	0
93PEC0	7/28/93	2	0	0	9	2	0
93PEC1	7/28/93	2	0	0	4	0	0
93PEC2	7/28/93	0	0	0	0	0	0
95PEC1	8/24/95	16	10	0	7	10	0

A=Rainbow Trout 0-4in
B= Rainbow Trout 4-8in
C= Rainbow Trout 8-12in
D= Brook Trout 0-4in
E = Brook Trout 4-8in
F = Brook Trout 8-12in

The habitat in this stream is in good condition for fish. Peace Creek is also considered to be "adjunct habitat" for bull trout. This would indicate that there is suitable habitat for spawning and rearing, however, whether it is used for these purposes is unknown. This watershed is affected by barriers and sediment tied primarily to dispersed recreation. In addition, brook trout occur within the watershed. Opportunities exist to remove brook trout, improve the dispersed recreation and return bull trout to suitable habitat within the drainage.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, observation, and judgement, this segment fall into the "full support" status category for cold water biota beneficial use. Salmonid spawning is occurring and is also in the "full support" status category. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation are in the "full support" category as well.

ID-17050121-15	**Silver Creek**	upstream limit: **headwaters**
	PNRS: **none**	downstream limit: **Peace Creek**

Current Classification in Idaho Water Quality Standards

map code: **map codes not available for unclassified water bodies**

This water body is: **Unclassified**

Designated Special Resource Water: IDAPA 16.01.02.95: **no**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **not assessed in 1988**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info : **not assessed in 1992**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **no water bodies assessed in 1994.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **no water bodies assessed in 1996.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-15 **Silver Creek** upstream limit: headwaters

PNRS: none downstream limit: Peace Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: "no cause: delisting proposed" assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: "no cause: delisting proposed" TMDL status: No TMDL Planned

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-15:	no	no	yes	no	yes*	yes	no**

* limit to *O. mykiss* and *S. confluentus* ** secondary unnecessary when primary is designated

Notes: ID-17050121-15 Silver Creek (upper)

This water body includes Silver Creek from its headwaters to the confluence with Peace Creek. Cabin Creek, Eggers Creek, Ucon Creek and Long Fork are tributaries to the main stem of Silver Creek along with several unnamed tributaries. Silver Creek is a third order stream from the confluence with the Middle Fork Payette River to its headwaters and is classified as a B3 Rosgen stream type. The channel bed is dominated by cobble sized materials and characterized by a series of rapids with irregularly spaced scour pads.

The upper Silver Creek watershed lies entirely within forest service land. The town of Crouch is located approximately twenty miles downstream from the confluence with the Middle Fork Payette River. Forest Service Road 671 parallels Silver Creek, crosses at Ucon Creek and dead ends at the confluence with Long Fork. Forest Road 678 enters the watershed from the northwest and forms a "T" with 671 1/4 mile upstream from Silver Creek Guard Station. Silver Creek Campground lies ½ mile downstream from the guard station.

Upper Silver Creek has not been monitored by DEQ prior to the BURP monitoring August 11, 1993.

Site ID	Location	MBI	HI
93SWIRO20	just d.s. from Ucon Creek	4.55	NA
93SWIRO21	just u.s. from Peace Creek	4.35	NA

The fish population was surveyed on July 24, 1996 by the Department of Fish & Game. The results were three age classes of wild rainbow trout (32 fish) and 25 Brook Trout.

The following is the fish data provided by Boise National Forest:

ID	DATE	A	B	C	D	E	F	G	H	I
93SLV6	7/27/93	4	0	1	0	0	0	0	3	1
93SLV7	7/27/93	2	1	5	1	1	7	3	4	8

93SLV8	7/27/93	3	2	0	0	0	0	0	6	0
93SLV9	7/28/93	3	1	0	0	0	0	0	1	0
93SLV10	7/28/93	4	0	0	0	0	0	0	0	0
93SLV11	7/28/93	5	0	0	0	0	0	0	1	0
93SLV12	7/28/93	1	0	0	0	0	0	0	0	0

A = Rainbow Trout 0-4in.
B = Rainbow Trout 4-8in.
C = Rainbow Trout 8-12in.
D = Rainbow Trout >12in.
E = Cutthroat Trout 0-4in.
F = Cutthroat Trout 4-8in.
G = Cutthroat Trout 8-12in.
H = Brook Trout 0-4in.
I = Brook Trout 4-8in.

Cutthroat Trout are not indigenous to the Middle Fork Payette watershed and are most likely planted.

Aquatic insects and other macroinvertebrates also inhabit this segment. DEQ's aquatic insect monitoring protocol calls for monitoring of aquatic insects in riffle habitat units. The insects collected in 1997 were collected for the riffle habitat. These samples are by no means definitive but they do give us a good idea of the condition of the aquatic insect community, and from that the relative status of the water quality. The collected insects were of assemblages that generally indicate good water quality.

The habitat in this stream is in good condition for fish. Upper Silver Creek is also considered to be "adjunct habitat" for bull trout. This would indicate that there is suitable habitat for spawning and rearing, however, whether it is used for these purposes is unknown. This watershed is affected by barriers and sediment tied primarily to dispersed recreation. In addition, brook trout occur within the watershed. Opportunities exist to remove brook trout, improve the dispersed recreation and return bull trout to suitable habitat within the drainage. Percent fines were <20%. This transect was dominated by riffles, with pools making up about 20% of the habitat. The majority of the streambanks were in stable condition.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the upper reaches of the stream, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, observation, and judgement, this segment fall into the "full support" status category for cold water biota beneficial use. Salmonid spawning is occurring and is also in the "full support" status category. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation are in the "full support" category as well.

ID-17050121-16 Middle Fork Payette River upstream limit: Bull Creek

PNRS: 703.00 downstream limit: Silver Creek

Current Classification in Idaho Water Quality Standards

map code: SWB-322 This water body is: Classified

Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-16 **Middle Fork Payette River** upstream limit: **Bull Creek**
PNRS: **703.00** downstream limit: **Silver Creek**

1998 Draft §305(b) and §303(d) Information

§303(d) listed: **yes**
cause: **sediment**

assessment info: **DEQ '96 WBA**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: **yes**
cause: **sediment**

TMDL status: **No TMDL Planned**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status	**Full Support**	**Full Support**	**Full Support**		**Full Support**	**Full Support**	**Full Support**

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-16:	**no**	**no**	**yes**	**no**	**yes***	**yes**	**no****

* limit to *O. mykiss* and *P. williamsoni* ** secondary unnecessary when primary is designated

Notes: ID-17050121-16 Middle Fork Payette River

This water body includes the segment of the Middle Fork Payette River from Silver Creek to Bull Creek. West Fork Creek, Skull Creek, Pine Creek, Wet Foot Creek, Bridge Creek, Bryan Creek, Dash Creek, Ground Hog Creek, Goat Creek and Lake Creek are tributaries to this segment. The Middle Fork Payette River is a fourth order stream and classified as a C5 Rosgen stream type. The bed and banks are dominated by cobble with occasional gravel, boulders and sand. This segment is a continuation of canyon morphology for the Middle Fork Payette River.

This segment of the Middle Fork Payette River lies entirely within the Boise National Forest with the exception of one section of state land located just north of Boiling Springs. The town of Crouch is located approximately 20 miles downstream from the confluence with Silver Creek. Boiling Springs forest campground and administration site are located along this segment of the river. Forest service road 698 parallels and crosses the river once and dead ends at the administrative site. Forest service road 678 begins at Boiling Springs campground, crosses the Middle Fork Payette River and proceeds up Bridge Creek to Silver Creek.

This segment of the Middle Fork Payette River has not been monitored by DEQ prior to BURP monitoring on July 20, 1994. Four sites exist in this segment.

Site ID	Location	MBI	HI
94SWIROA42	@ Boiling Springs CG	5.09	102
95SWIROC26	100 feet above Boiling Springs CG	4.63	73
97SWIROA70	Upstream from Boiling Springs CG	4.44	71
97SWIROA73	West Fork Creek @ mouth	5.03	99

The Boise National Forest also surveyed this segment several times in 1986.

The fish population has been surveyed by the Boise National Forest (1993) using their aquatic survey database. The results were a reduced rainbow trout population and no bull trout. Additional IDFG fish survey information from July 22, 23 and 24, 1996 is as follows:

Location	Hatchery RBT	Wild RBT	Mtn Whitefish	Bull Trout	Long Nosed Dace
just above FS admin site	0	1	0	0	0
0.7 miles d.s. from FS admin site	1	7	2	1	1
1.5 miles u.s. from FS admin site	0	8	11	0	0
2.2 miles d.s. from FS admin site	0	17	8	1	0
3.9 miles d.s. from FS admin site	0	15	0	0	0

BURP monitoring found the stream bed to be predominantly cobble followed by small boulders and sand.

This segment of the Middle Fork Payette River is currently appropriate for and utilized by three species of native salmonid fishes, Whitefish (*P. williamsoni*), redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). Redband trout use this stream and may be more abundant, year round, if habitat complexity increased, including spawning areas. It is essential that Bull trout be able to better utilize this segment for migration to the rest of the Payette bull trout populations.

Based on the BURP monitoring, the habitat in this segment is in a fair condition for fish. Riffle habitat dominates this segment of the river, followed by runs and glides. Pools are minor or missing.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. Both macroinvertebrate and one of the habitat values show non impairment, based on current assessment protocols. Considering the number and age classes of fish found in the BNF survey, the amount of bed load sediment in this segment does not appear to impair Cold Water Biota as a beneficial use.

All water supply and recreational beneficial uses have been "full support" for the last five years. Salmonid Spawning beneficial use is also "full support". Both native mountain whitefish and redband trout spawn in this section. Both Mountain whitefish (broadcast spawners) and Redband Trout (redd builders) are successful in this section of the Middle Fork Payette River or neighboring streams. Bull trout spawning is only going to occur further up in the watershed.

It is important to note that loss of anadromous fish, introduction of non-native fishes, and nearby stocking of hatchery fish for a "put and take fishery" have greatly affected the complex interactions of the remaining native salmonids. It is difficult to define or assure recovery given these other population controlling issues.

ID-17050121-17 **Bull Creek** upstream limit: **headwaters**

PNRS: 708.00 downstream limit: **Middle Fork Payette River**

Current Classification in Idaho Water Quality Standards

map code: **map codes not available for unclassified water bodies**

This water body is: **Unclassified**

Designated Special Resource Water: IDAPA 16.01.02.95: **no**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **not assessed in 1988**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info : **not assessed in 1992**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **no water bodies assessed in 1994.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: **no**
cause:

assessment info: **no water bodies assessed in 1996.**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-17	Bull Creek	upstream limit: headwaters
	PNRS: 708.00	downstream limit: Middle Fork Payette River

1998 Draft §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: no
cause:

TMDL status:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-17:	no	no	yes	no	yes	yes	no*

* secondary unnecessary when primary is designated

Notes: ID-17050121-17 Bull Creek

This water body includes Bull Creek from its headwaters to the confluence with the Middle Fork Payette River. Sixteen-to-one Creek and Oxtail Creek are tributaries to the main stem of Bull Creek along with several unnamed tributaries. Bull Creek is a third order stream from the confluence with the Middle Fork Payette River to its headwaters and is classified as a B3 Rosgen stream type.

The Bull Creek watershed lies entirely within forest service land. There are no roads in the watershed.

Bull Creek has not been monitored by DEQ. Bull Creek has been monitored by Boise National Forest. The following is from their surveys:

ID	DATE	A	B	C	D
93BUL0	8/27/93	0	0	0	0
93BUL1	8/27/93	7	2	0	0
93BUL2.5	8/27/93	7	1	0	0
93BUL3.5	8/27/93	17	3	0	0
93BUL4.5	8/27/93	6	1	0	0
93BUL5.5	8/27/93	1	0	1	0
93BUL6.5	9/12/93	0	0	0	0
93BUL7.5?	8/27/93	0	0	0	0
93BUL8.5	8/27/93	0	0	2	0
93BUL9.5	8/27/93	1	0	0	0
93BUL10.5	9/11/93	0	0	0	1
93BUL11	9/11/93	0	0	3	3
93BUL12	9/11/93	0	0	0	1

A = Rainbow Trout 0-4in.

B = Rainbow Trout 4-8in.
C = Bull Trout 0-4in.
D = Brook Trout 0-4in.

Based on limited access and management, the habitat in this stream should be in good condition for fish. Bull Creek also contains "adjunct habitat" and "focal habitat" (in the headwaters) for bull trout. "Adjunct habitat", below mile 5, would indicate that there is suitable habitat for spawning and rearing, however, whether it is used for these purposes has not been documented. "Focal habitat", above mile 5, currently supports bull trout spawning and rearing. Bull Creek contains a depressed bull trout population. It appears to be threatened by brook trout in the headwaters and naturally high sediment levels within the roadless area.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the upper reaches of the stream, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, observation, and judgement, this segment fall into the "full support" status category for cold water biota beneficial use. Salmonid spawning is occurring and is also in the "full support" status category. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation are in the "full support" category as well. As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the watershed, bacteria counts should be low.

ID-17050121-18 **Middle Fork Payette River** upstream limit: headwaters
PNRS: 703.00 downstream limit: Bull Creek

Current Classification in Idaho Water Quality Standards

map code: SWB-322 This water body is: Classified

Designated Special Resource Water: IDAPA 16.01.02.95: yes

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	yes	yes	yes	no	yes	yes	yes

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988	Full Support	Full Support	Full Support		Full Support	Full Support	Full Support

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : evaluated

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992	Full Support	Full Support	Partial Support		Full Support	Full Support	Full Support

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-18 **Middle Fork Payette River** upstream limit: headwaters

PNRS: 703.00 downstream limit: Bull Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: no
cause:

TMDL status:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-18:	yes	yes	yes	no	yes	yes	no*

* secondary unnecessary when primary is designated

Notes: ID-17050121-18 Middle Fork Payette River

This water body includes the segment of the Middle Fork Payette River from Bull Creek to the headwaters. Fool Creek and Ligget Creek are the only two named tributaries to this segment. The Middle Fork Payette River is a second order stream and classified as a B Rosgen stream type at it's mouth. The bed and banks are dominated by cobble with occasional gravel, boulders and sand. This segment is a continuation of canyon morphology for the Middle Fork Payette River.

This segment of the Middle Fork Payette River lies entirely within the Boise National Forest. There is no development in this segment, and it is predominantly unroaded. Forest road 409 runs parallel to the river from the headwaters for approximately two miles. Forest road 405 enters the watershed from Clear Creek and dead ends approximately ½ mile from the river. Forest road 475 also enters the watershed and dead ends at Ligget Creek.

This segment of the Middle Fork Payette River was first monitored by DEQ on August 7, 1996. One site exists in this segment.

Site ID	Location	MBI	HI
96SWIROA78	@ trail 79 crossing just west of Eureka Pt.	5.31	114

BURP monitoring found the stream bed to be predominantly cobble followed by gravel, small boulders and sand.

The following is the fish data provided by Boise National Forest:

ID	DATE	A	B	C	D	E
94MFP45.5	na	0	0	0	0	1
93MFP42.5	na	12	4	0	2	0
93MFP43	na	0	1	0	0	0
93MFP44.5	na	0	0	1	5	0

93MFP45	na	0	0	17	10	0
93MFP33.5	8/29/93	0	0	0	0	0
93MFP34.5	8/29/93	16	0	0	0	0
93MFP36	8/29/93	10	2	0	0	0

A = Rainbow Trout 0-4in.
B = Rainbow Trout 4-8in.
C = Bull Trout 0-4in.
D = Bull Trout 4-8in.
E = Brook Trout

This segment of the Middle Fork Payette River is currently appropriate for and utilized by two species of native salmonid fishes, redband trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*). Based on limited access, and management, the habitat in this stream should be in good condition for fish. This segment of the Middle Fork Payette River also contains "adjunct habitat" (below mile 36) and "focal habitat" (in the headwaters, above mile 36) for bull trout. "Adjunct habitat" would indicate that there is suitable habitat for spawning and rearing, however, whether it is used for these purposes has not been documented. "Focal habitat" currently supports bull trout spawning and rearing.

Based on the BURP monitoring for this segment, the habitat in this segment is in a good condition for fish. Riffle habitat dominates this segment of the river, followed by runs and glides. Pools make up about 5% of the habitat.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. Due to a lack of development in the watershed, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* have not been exceeded by any data generated sampling this water body. Based on current assessment protocols, observation, and judgement, this segment fall into the "full support" status category for cold water biota beneficial use. Salmonid spawning is occurring and is also in the "full support" status category. Agricultural Water Supply, Domestic Water Supply, Warm Water Biota, and Secondary Contact Recreation are neither designated nor existing and therefore have not been assessed. Primary Contact Recreation are in the "full support" category as well. As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the watershed, bacteria counts should be low.

ID-17050121-19 **Scriver Creek** upstream limit: Middle Fork Scriver Creek

PNRS: none downstream limit: Middle Fork Payette River

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: Unclassified

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-20	**Scriver Creek**	**upstream limit: headwaters**
	PNRS: none	**downstream limit: Middle Fork Scriver Creek**

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: **Unclassified**

Designated Special Resource Water: IDAPA 16.01.02.95: **no**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : **not assessed in 1992**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1994. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: yes
cause: sediment

assessment info: no water bodies assessed in 1996. 303(d) listing resulted from Boise National Forest analysis.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-20	Scriver Creek	upstream limit: headwaters
	PNRS: none	downstream limit: Middle Fork Scriver Creek

1998 Draft §305(b) and §303(d) Information

§303(d) listed: "no cause: delisting proposed" — assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: "no cause: delisting proposed" — TMDL status:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			**Full Support**		**Full Support**	**Full Support**	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-20:	no	no	yes	no	yes	yes	no*

* secondary unnecessary when primary is designated

Notes:

ID-17050121-20 Scriver Creek

This water body includes Scriver Creek from its headwaters to the Middle Fork Scriver Creek. There are several small tributaries to the main stem of Scriver Creek, Middle Fork, West Fork and Bear Wallow Creek. Scriver Creek is a second order stream above Middle Fork Scriver Creek and is classified as a B Rosgen stream type. The bed and banks are dominated by cobble followed by gravel, boulders and sand.

The watershed includes state and forest service land. The town of Crouch is located five miles downstream from the confluence of Scriver Creek and the Middle Fork Payette River. Forest Service Road 693 parallels Scriver Creek for almost its entire length and crosses twice during the length of this water body.

The upper portion of Scriver Creek has not been monitored by DEQ.

The following is the fish data provided by Boise National Forest:

SITE	DATE	A	B	C	D
94WSCR07	na	1	1	16	0
94WSCR17	na	5	0	8	4

A=Rainbow trout 0-4 in.
B=Rainbow trout 4-8 in.
C=Brook trout 0-4 in.
D=Brook trout 4-8 in.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not

ID-17050121-19	Scriver Creek	upstream limit: Middle Fork Scriver Creek
	PNRS: none	downstream limit: Middle Fork Payette River

1998 Draft §305(b) and §303(d) Information

§303(d) listed: "no
cause: delisting proposed"

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: "no
cause: delisting proposed"

TMDL status:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			Full Support		Full Support	Full Support	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-19:	no	no	yes	no	yes	yes	no*

* secondary unnecessary when primary is designated

Notes: ID-17050121-19 Scriver Creek

This water body includes Scriver Creek from Middle Fork Scriver Creek to the Middle Fork Payette River. There are several small tributaries to the main stem of Scriver Creek, Pinney Creek, Left Fork, Hidden Creek and Middle Fork. Scriver Creek is a third order stream from the confluence with the Middle Fork Payette River to Middle Fork Scriver Creek and is classified as a B Rosgen stream type. The bed and banks are dominated by cobble followed by gravel, boulders and sand.

The lower three miles of Scriver Creek flows through private land, with some development. The watershed also includes state and forest service land in the headwaters and two small parcels of BLM land. The town of Crouch is located five miles downstream from the confluence of Scriver Creek and the Middle Fork Payette River. Drinking water for development in the area is supplied by wells, and wastewater disposal utilizes septic tanks. Some of the low lying land immediately adjacent to Scriver Creek is used as pasture or wetland sinks. Forest Service Road 693 parallels Scriver Creek for almost its entire length and crosses twice during the length of this water body.

Scriver Creek has not been monitored by DEQ prior to the BURP monitoring August 12, 1993. One site (93SWIRO19) was established just upstream of the forest service boundary. The forest service submitted Baseline Inventory information taken September 16, 1986.

The following is the fish data provided by Boise National Forest:

ID	DATE		A	B	C	D
94SCR6	na		15	10	9	15
94SCR7	na	6	4	23	5	
94SCR8	na		4	11	3	6
94SCR9?	na	3	1	0	0	

A=Rainbow trout 0-4 in.
B=Rainbow trout 4-8 in.

C=Brook trout 0-4 in.
D=Brook trout 4-8 in.

Habitat information (percent fines 7.5%) and macroinvertebrate data (several cold water indicators) indicate that this stream should support a fishery.

Aquatic insects and other macroinvertebrates also inhabit this segment. DEQ's aquatic insect monitoring protocol calls for monitoring of aquatic insects in riffle habitat units. The insects collected in 1993 were collected for the riffle habitat. These samples are by no means definitive but they do give us a good idea of the condition of the aquatic insect community, and from that the relative status of the water quality. The collected insects were of assemblages that generally indicate good water quality.

The habitat in this segment is in fair to good condition for fish. Cobble (64-256 mm) dominate channel bed and banks. Gravel/boulder bars are frequent. Pools make up about 25% of the stream with the remainder dominated by riffles.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the upper reaches of the stream, bacteria counts should be low.

Numeric criterion in ***Idaho's Water Quality Standards*** have not been exceeded by any data generated sampling this water body. The previously mentioned BURP monitoring and the available fish information indicate this stream fully supports cold water biota as a beneficial use.

clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the upper reaches of the stream, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. Based on the lack of development and management in this watershed and the relative abundance of fish considering the size of the stream, this stream fully supports cold water biota as a beneficial use.

ID-17050121-21 **Middle Fork Scriver Creek** upstream limit: headwaters

PNRS: none downstream limit: Scriver Creek

Current Classification in Idaho Water Quality Standards

map code: map codes not available for unclassified water bodies

This water body is: Unclassified

Designated Special Resource Water: IDAPA 16.01.02.95: no

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for this water body:	no	no	yes*	no	no	yes*	no

* denotes implicit designation through IDAPA 1601.02.101.01.a.

1988 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: not assessed in 1988

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1988							

1992 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info : not assessed in 1992

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1992							

1994 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1994.

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1994							

1996 §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info: no water bodies assessed in 1996.

ID-17050121-21 **Middle Fork Scriver Creek** upstream limit: **headwaters**

PNRS: **none** downstream limit: **Scriver Creek**

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1996							

ID-17050121-21 **Middle Fork Scriver Creek** upstream limit: **headwaters**

PNRS: none downstream limit: **Scriver Creek**

1998 Draft §305(b) and §303(d) Information

§303(d) listed: no
cause:

assessment info:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
status assessment for 1998							

1998 Sub-basin Assessment Information

§303(d) listed: no
cause:

TMDL status:

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
sub-basin assessment status			**Full Support**		**Full Support**	**Full Support**	

Recommended Designations for Idaho Water Quality Standards

Idaho's Beneficial Uses: IDAPA 16.01.02.100	Domestic Water Supply	Agricultural Water Supply	Cold Water Biota	Warm Water Biota	Salmonid Spawning	Primary Contact Recreation	Secondary Contact Recreation
Designated Beneficial Uses for ID-17050121-21:	no	no	yes	no	yes	yes	no*

* secondary unnecessary when primary is designated

Notes: ID-17050121-21 Middle Fork Scriver Creek

This water body includes Middle Fork Scriver Creek from its headwaters to Scriver Creek. There are several unnamed tributaries to the Middle Fork Scriver Creek. Middle Fork Scriver Creek is a second order stream and is classified as a B Rosgen stream type. The bed and banks are dominated by cobble followed by gravel, boulders and sand.

The watershed includes state and forest service land. The town of Crouch is located five miles downstream from the confluence of Scriver Creek and the Middle Fork Payette River. Forest Service Road 695 crosses the creek in the upper part of the watershed.

The following is the fish data provided by Boise National Forest:

SITE	DATE	A	B	C	D
94MSCR0	na	10	12	2	3
94MSCR1	na	12	14	0	0

A=Rainbow trout 0-4 in.
B=Rainbow trout 4-8 in.
C=Brook trout 0-4 in.
D=Brook trout 4-8 in.

As far as it is known, this water body is free of water column contamination, excepting high levels of event driven suspended sediment. It is not clear if and how this suspended sediment impairs beneficial uses. The stream gradient does not allow for significant deposition of fine sediment. Due to a lack of development in the upper reaches of the stream, bacteria counts should be low.

Numeric criterion in *Idaho's Water Quality Standards* have not been exceeded by any data generated sampling this water body. Based on the lack of development and management in this watershed and the relative abundance of fish considering the size of the stream, this stream fully supports

cold water biota as a beneficial use.

Appendix B: Middle Fork Payette River Sediment Load Estimates and Reach Transport Capacities

1. Introduction

The Middle Fork Payette River typically receives sediments from landslides, forest roads, unstable stream banks, and exposed soil areas due to construction and agriculture activities. Gravel sized sediments (<8 mm) originating in the upper watershed and tributaries are routed down steep channels and accumulate in the flatter reaches in the lower portion of the basin. Sediment monitoring over the past year has indicated that the sediment loads entering the Middle Fork Payette River do not produce high turbidities or suspended sediments, but do contribute a large amount of material to the bedload (Fitzgerald et al, 1998b). The primary nonpoint sources (NPS) of pollutants in the Middle Fork Payette River basin are forest management activities, grazing, small scale agriculture operations, county road construction and management, urban runoff, and land development activities.

The narrative Idaho water quality standard for sediment states that "sediment shall not exceed quantities...which impair designated beneficial uses" (IDAPA 16.01.02.200.08.). The sediment targets established by this document is an interpretation of this narrative water quality standard. Section 2 of this TMDL examines how the identified beneficial uses are impacted due to excess sediment. Based on this analysis targets are established for an allowable amount of sediment above background for each of the impaired reaches within the Middle Fork Payette River sub-basin.

Sediment loads can be characterized by their frequency of delivery, particle size compositions, and amounts. For example, surface erosion from new road construction can deliver fine sediments to a stream on a frequent basis over a two to three year period. The high frequency of this delivery can combine with a large amount of available material when many new roads are constructed at once, thus producing a large sediment load. Once a road has aged a few years, the frequency and amount of fine sediment delivery diminishes dramatically. Debris flows and other forms of mass wasting, on the other hand, can deliver a large amount of fine and coarse sediments to a stream during a single event. The remaining debris flow paths which remain after the event can produce surface erosion for a few years, much like a newly constructed road. Additional characteristics of debris flow deliveries are that they often occur during high stream flow events and occur less frequently than new road construction surface erosion sediment delivery events.

In order to define an excessive sediment load, the receiving body's assimilative capacity needs to be evaluated. Assimilative capacities of a receiving body can change according to flow, sediment particle size, and channel geometry. Frequent delivery of fine sediments from excessive surface erosion is thought to impact the channel bed surface composition, shifting the composition from a more coarse to a more fine particle size distribution. Frequent delivery of coarse and fine sediments from frequent mass wasting, on the other hand, is thought to impact the channel geometry by shallowing and widening it. Additionally, the frequency of sediment delivery can influence a stream's assimilative capacity. Rare and infrequent mass wasting events, for example, tend to cause few changes to the channel geometry. If the frequency of these events increase, the channel may accommodate these ongoing sediment loads by widening and shallowing. This follows the observations that as the sediment load increases over a long period, the channel configuration changes in order to accommodate (i.e., transport) this sediment load.

The load capacity and allocations proposed for the Middle Fork Payette River within this TMDL are based on the results of an analysis of reach transport capacity. This analysis utilizes the current reach geometry characteristics, estimated background sediment levels from BoiSed, the Parker Transport Capacity Equation, and a sediment transport coefficient. Essentially, background sediment rates are estimated using BoiSed; the amount of sediment transported to a stream from an upslope activity is estimated using a sediment delivery coefficient; and the transport capacity and rate of deposition down the mainstem of the Middle Fork Payette River is estimated using the Parker Transport Capacity Equation. The rate of sediment deposition was then increased until the rate of deposition within each reach was 50% above estimated background deposition rates.

2. Background Sediment Load

Natural and management induced sediments sources in the Middle Fork Payette River have been studied by numerous individuals and agencies. The climatic, hydrologic, geologic, soils, vegetation and landform characteristics of this watershed are the cause of naturally high erosion rates (Reinig *et* al., 1991; Clayton, 1986; Megahan and Ketcheson, 1996; USDA, 1976). Historic and present land use have increased erosion rates and sediment yield, and caused excess sedimentation of the mainstem Middle Fork Payette River.

Once sediment reaches an active stream channel there are a variety of hydrologic processes that store or transport sediment down-stream. Sediment storage and transport are a function of sediment characteristics (e.g., input grain size distribution and fall velocity), channel energy dissipation (i.e., roughness), reach slope, and flow level. When the sediment input is increased within a stream system an overall decrease in the mean particle size or a widening and shallowing of the channel geometry occurs due to the change in the sediment transport capacity of a reach.

2.1. Background Hillslope Erosion Rates

Natural hillslope erosion processes include hillslope creep, mass failure, and surface erosion. Acceleration of erosion rates prior to anthropogenic land use change likely occurred as a result of fire and episodic precipitation, snowmelt, and flood events. In the Middle Fork Payette River, natural sources of sediment that results from bank erosion and channel degradation appear to be low relative to hillslope erosion rates.

Land managers within the Middle Fork Payette River sub-basin have evaluated background and management related erosion rates through the use of models. Two of these include BoiSed (Reinig et al., 1991) and SedMod (Boise Cascade, 1998). Background erosion rates in BoiSed are based on erosion rates measured during a long-term study within the Silver Creek drainage of the Middle Fork Payette River basin. These background rates include sediment inputs from hillslope creep, landslides, and other erosion mechanisms present under natural forested conditions (Table 1).

Table 1: BoiSed Background Hillslope Sediment Production with Sediment Transport Coefficient

Pure Watersheds	Background Sediment * (tonnes/yr; tons/yr)	Potential Stream Power	Discharge Coefficient	Discharge Adjusted Potential Stream Power**	Deposition Ratio	Potential Sediment Transport Coefficient***	Amount Delivered (tonnes/yr; tons/yr)
Upper MF Payette	1205; 1328	0.078	0.092	0.007	0.562	0.013	16; 17
Bull Creek	977; 1077	0.098	0.158	0.015	0.334	0.046	45; 50
Bridge-Bryon	1230; 1356	0.236	0.033	0.008	0.477	0.016	20; 22
Sixmile	1852; 2041	0.112	0.040	0.005	0.553	0.008	15; 16
Silver Creek	985; 1086	0.095	0.169	0.016	0.407	0.039	38; 42
Rattlesnake	255; 281	0.160	0.032	0.005	0.485	0.011	2.8; 3.1
Rocky Canyon	529; 583	0.637	0.076	0.048	0.712	0.068	36; 40
Bulldog Creek	491; 541	0.197	0.052	0.010	0.249	0.041	20; 22
Lightning Creek	621; 685	0.180	0.096	0.017	0.344	0.050	31; 34
Pyle	383; 422	0.262	0.120	0.031	1.046	0.030	12; 13
Scriver Creek	831; 916	0.209	0.116	0.024	0.463	0.052	43; 48
Anderson Creek	1046; 1153	0.167	0.143	0.024	0.370	0.065	68; 75

* Based on BoiSed Background Sediment Rate Estimates
** Stream Power x Discharge Coefficient (Fitzgerald et al, 1998a)
*** Adjusted Stream Power/Deposition Ratio (Fitzgerald et al, 1998a)

3. Middle Fork Payette River Streamflow

The transport capacity analysis used to determine hillslope erosion targets is based on existing reach geometry and the recurring two-year flow. A two-year flow per drainage area relationship was used to estimate the recurring two-year flow for each reach examined.

3.1. Annual Hydrograph

A long record of streamflow data is unavailable for the Middle Fork Payette River. However, a USGS gage on the South Fork Payette River at Garden Valley, Idaho, and a USGS gage on the main Payette River at Banks, Idaho were in operation between 1921 and 1960. The difference between these two gages includes the Middle Fork Payette River sub-basin and side drainages between Garden Valley and Banks. The annual hydrograph for the Middle Fork Payette River sub-basin from this analysis is presented in Figure 1.

A storm frequency and duration analysis was conducted for the Middle Fork Payette River and side drainages using the USGS daily flow data (IDEQa, 1998). Storm duration for the two-year flow was approximately 2 days.

Flow data is also available from a short-term monitoring study conducted by the EPA within the Middle Fork Payette River basin during the spring of 1998 (Fitzgerald, 1998). Flow was measured during a bankfull storm event on March 25, 1998. These flows were plotted against the drainage area for the reach for the following relationship:

$$Q_2 = 1.8 A_{dr}^{1.2809}$$

where:

Q_2 = Bankfull Discharge (cfs)
A_{dr} = Drainage Area (mi²)

The two-year flow used in the transport capacity analysis relied on this relationship.

4. Sediment Transport Analysis

Once sediment has reached an active stream channel there are a variety of hydrologic processes that store sediment in an active channel or transport sediment down-stream. Sediment storage and transport are a function of sediment characteristics (i.e., input grain size distribution, fall velocity, shear stress), channel roughness, reach slope, and flow level. Also, as mentioned above, when the amount and frequency of sediment input changes, changes to channel geometry an overall decrease in the mean particle size may occur. These changes in channel geometry and substrate influence the channel's sediment transport capacity.

The objective of the sediment transport analysis presented here is to show how an increase in sediment input to a reach changes the transport capacity and rate of deposition within that reach. A change in deposition rate of 50% above background deposition rates, as shown by the transport model, was selected as an allowable change in deposition due to management activities.

4.1. Reach Selection and Characteristics

The Middle Fork Payette River was broken up into seven reaches. The partitioning of the reaches selected was based on stream slope similarity and significant tributary sediment sources. The reaches were numbered from the upper end of the Middle Fork Payette River (Reach 1) to the confluence with the South Fork Payette (Reach 7) (Figure 2).

Load capacities and allocations are established in the Middle Fork Payette River TMDL for the contributing areas to the lowest three reaches (5, 6, and 7). The contributing area for Reach 5 includes the entire sub-basin area upslope and upstream of a point just downstream of the confluence between Lightning Creek and Middle Fork Payette River. The contributing area for Reach 6 includes the entire sub-basin area upslope and upstream of a point just upstream of the confluence between Anderson Creek and the Middle Fork Payette River. The contributing area for Reach 7 is the entire Middle Fork Payette sub-basin drainage.

Characteristics used in the transport capacity estimates are presented in Table 2. The channel geometry dimensions used for the two-year flow are based on measured cross-section data (IDEQa, 1998). The channel Manning's n was estimated using Cowen's method at each cross-section (Chow, 1959). The lengths and slopes of each reach were obtained from 7.5 minute, 1:24,000 USGS quadrangle maps. The drainage area for each reach was determined by adding up each of the upstream sub-watershed areas.

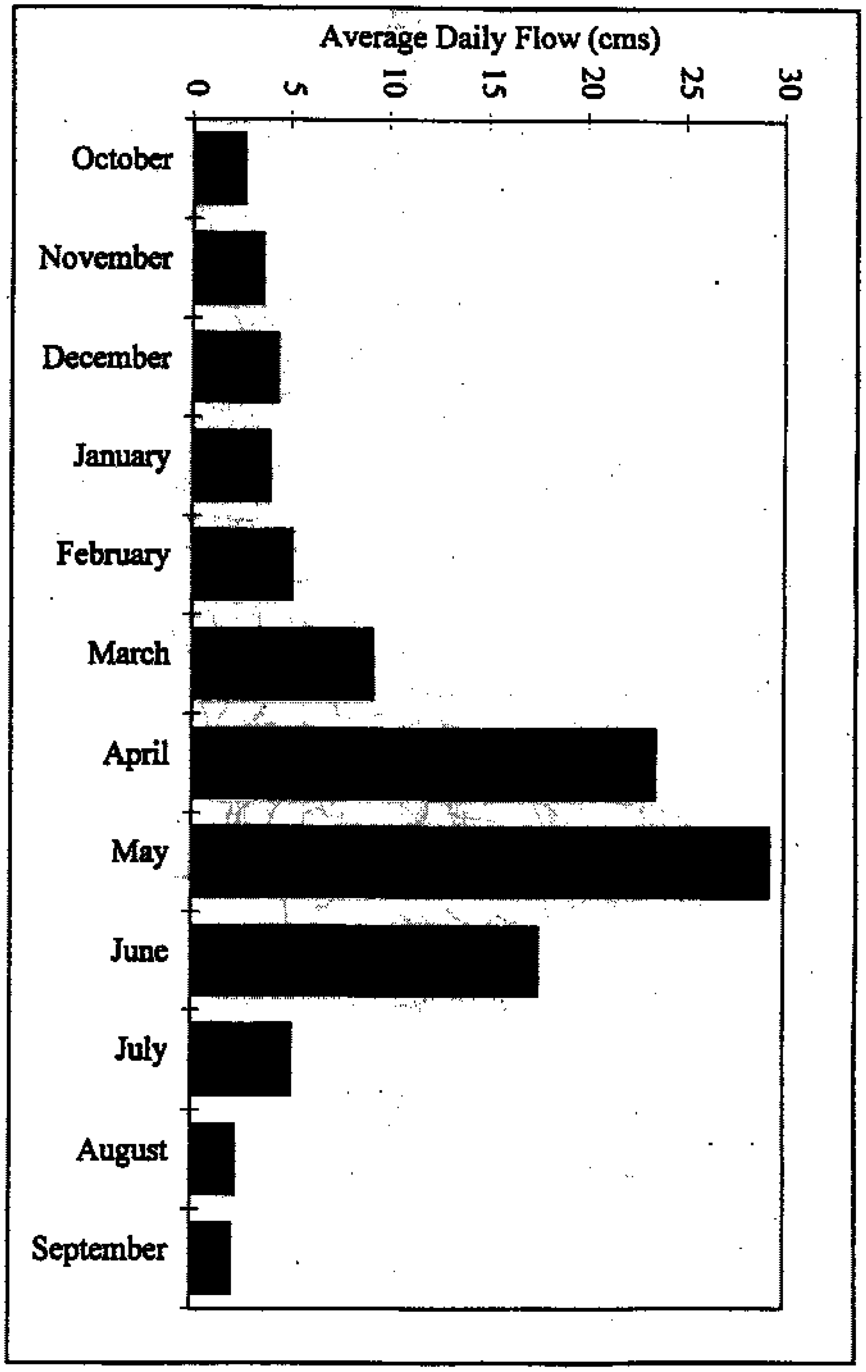

Figure 1: Annual Hydrograph of the Middle Fork Payette River

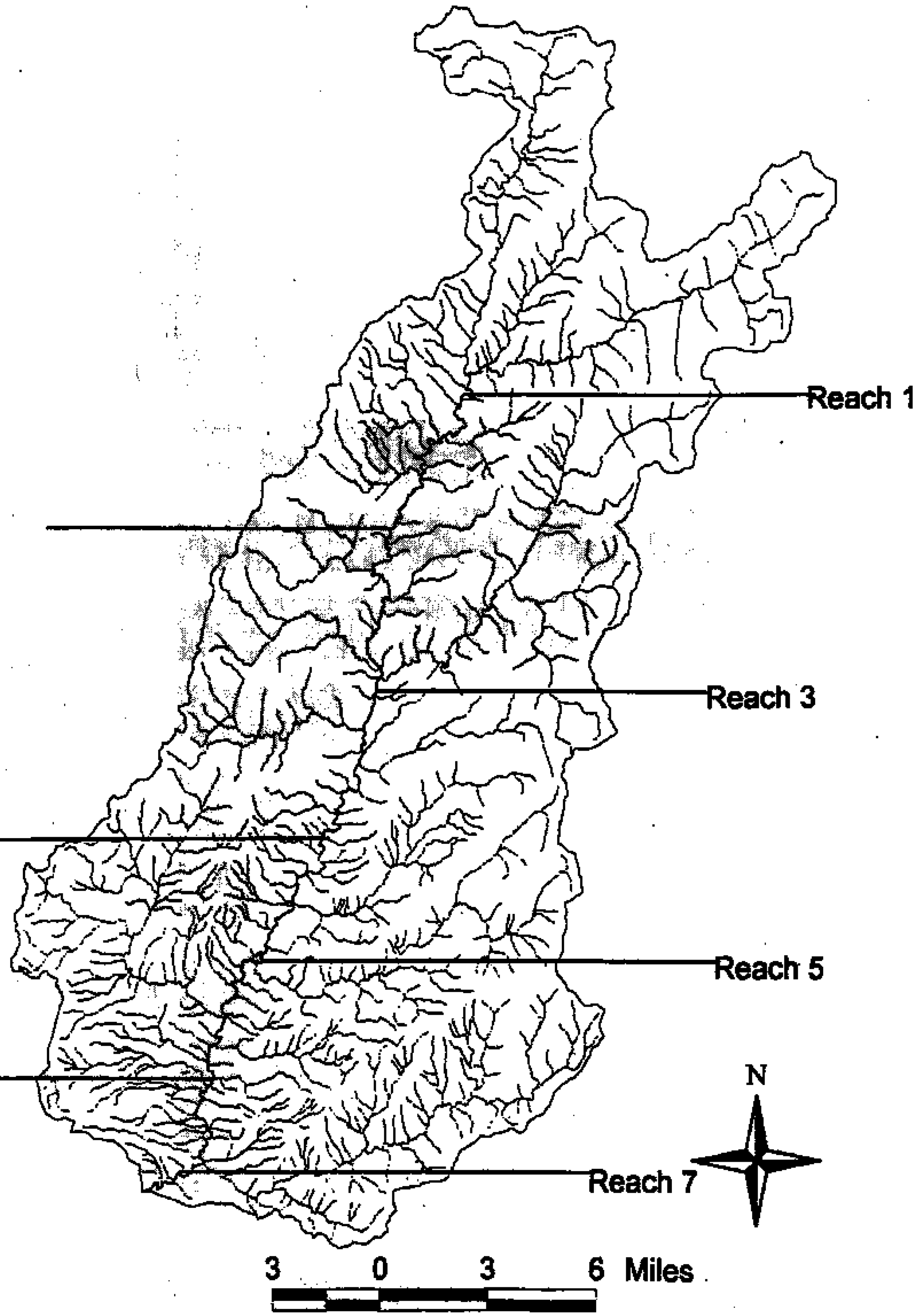

Figure 2: Reach Location Map

Table 2: Reach Characteristics

Reach	W (m)	WP (m)	A (mi²)	R	L (km)	Slope	n	A_{dr} (Ha)	Q_2 (cms)	Sub-Watershed
R1	16	16.9	10.4	0.62	12.9	0.0101	0.066	1.98	13.2	UP, B, N-BB
R2	16	16.3	11.5	0.71	10.5	0.0065	0.060	2.33	16.2	S-BB
R3	22	22.4	19.6	0.88	13.3	0.0087	0.055	4.40	36.7	SV, SX
R4	33	33.3	19.1	0.57	9.7	0.0168	0.035	4.67	39.7	RT, N-RC
R5	25	26.1	32.2	1.23	7.2	0.0031	0.035	6.35	58.6	BD, LT, S-RC
R6	38	39.4	70.5	1.79	8.8	0.0010	0.035	8.03	79.2	SC, PY
R7	27	28.2	47.5	1.68	3.7	0.0010	0.027	8.83	89.4	AN

W = Width; WP = Wetted Perimeter; A = Cross-Sectional Area; R = Hydraulic Radius; L = Length; n = manning's n; A_{dr} = Reach Drainage Area; Q_2 = Two-Year Streamflow; UP = Upper Payette; B = Bull; N-BB = North Bridge-Bryon; S-BB = South Bridge-Bryon; SV = Silver; SX = Sixmile; RT = Rattlesnake; N-RC = North Rocky Canyon; BD = Bulldog; LT = Lightning; S-RC = South Rocky Canyon; SC = Scriver; PY = Pyle; AN = Anderson

4.2. Reach Sediment Transport Capacity

4.2.1 Method and Inputs

An analysis of reach transport capacity was conducted using current reach geometry characteristics and background sediment levels. These background sediment levels were then increased until the rate of deposition within each reach was 50% above background deposition rates. Sediment transport for bedload used Parker's equation for uniform mobility for each particle size class (Parker, 1990; Kinerson, 1986; Wilcock et al, 1996; Andrews and Nankervis, 1995).

Table 1 presents the amount of background hillslope erosion estimated to enter the Middle Fork Payette River (see Amount Delivered, Table 1). These average annual sediment inputs were partitioned into particle size classes based on the Soil Survey of the Middle Fork Payette River Basin (USDA, 1976).

Beginning in the uppermost reach (Reach 1), background sediment input was totaled for each of the contributing sub-watersheds and routed through the reach. Those sediments that were shown to be output at the bottom of the first reach were then routed to the second reach as primary input. Tributary background sediment input from the contributing sub-watershed were then added to the primary input within the second reach and routed to the third reach. This pattern (i.e., adding the sediment routed down from upper reaches to the tributary inputs from the nearby sub-watersheds, then routing the total down to the next reach) was continued down until the confluence with the South Fork Payette River. Sediment input from the sub-watersheds was then increased until the deposition rate within each reach was 50% above the deposition rate during background input levels.

Certain inputs and results of the sediment transport capacity model were checked for each reach in order to determine how well the inputs and model fit within the Middle Fork Payette River system. These included a check on the channel geometry during the two-year flow, and a check on the observed verses the predicted medium particle size (i.e., D50) for the reach. The results of these checks are presented in Table 3.

Table 3: Parker Transport Capacity Model Input and Reach Medium Size Particle Check

Reach	Two-Yr Flow (cfs) (Provided)*	Two-Yr Flow (cfs) (Predicted)**	Percent Difference in Flow (%)	Medium Particle Size (mm) (Observed)	Medium Particle Size (mm) (Bkgrd)	Medium Particle Size (mm) (Target)
R1	13.2	11.5	-13	68	77	75
R2	16.2	12.2	-25	68	54	52
R3	36.7	30.5	-17	97	93	90
R4	42.9	47.9	12	119	116	113
R5	**58.6**	**58.8**	**0**	**38**	**41**	**40**
R6	**79.2**	**93.9**	**19**	**5**	**18**	**17**
R7	**89.4**	**79.2**	**-12**	**5**	**16**	**15**

*Based on Fitzgerald, 1998b

**Based on the Manning's Equation for the Q_2 channel cross-section (Richards, 1982; IDEQa, 1998).

4.2.2. Model Application and Assumptions

The Parker bedload equation is used in the Middle Fork Payette River TMDL loading analysis to develop an allowable rate of deposition above background. This model is an empirical model developed on streams with gravel substrates. Validation studies of the Parker model have been conducted in the Seirra batholith streams (Andrews and Nankervis, 1995). Because the Middle Fork Payette River is dominated by gravel size substrate in the lower reaches (i.e., D50 = 5 mm diameter) the Parker equation was determined to be appropriate. Assumptions used in the current application are as follows:

- Steady and uniform flow conditions at bankfull stage represents the two year (i.e., channel forming) flow.
- Channel roughness, slope, and geometry are uniform along each of the designated reaches.
- The sediment particle size distribution entering the tributaries and the Middle Fork Payette River is uniform throughout the sub-basin.

4.2.3. Reach Transport Capacity Results

Table 4 summarizes the results of these transport capacity estimates and converts the sediment input to the Middle Fork Payette River into the target erosion rate from hillslope management activities. Table 5 lists the management target input in "percent above background" and "tonnes per year" for each Sub-watershed.

Table 4: Sediment Input Rate Results by Reach

Reach	Background Input Entering MF Payette (tonnes/yr)	Background Rate of Deposition (tonnes/yr)	Target Rate of Deposition (tonnes/yr)	Load Capacity (% Above Background)	Cumulative Load Capacity* (% Above Background)
R1	71	4.2	6.3	50	50
R2	10	3.0	4.5	44	48
R3	53	2.3	3.45	49	47
R4	21	0.8	1.2	50	48
R5	**69**	**16.2**	**24.3**	**56**	**50**
R6	**55**	**35.8**	**53.7**	**26**	**46**
R7	**68**	**29.5**	**44.2**	**48**	**47**

***Based on increases to BoiSed background amounts delivered to each stream reach.**

Table 5: Load Capacity, MOS, and Management Targets

Reach	Cumulative Load Capacity (% above background)	Cumulative Load Capacity (tons/yr)	Cumulative Background Load (tons/yr)	Cumulative Margin of Safety (tons/yr)	Cumulative Management Allocation (tons/yr)	Cumulative Management Allocation (% above bkgrd)
R1	50	4624	3083	462	1079	35
R2	48	5600	3761	560	1279	34
R3	47	10164	6888	1016	2260	33
R4	48	11867	8002	1187	2678	33
R5	**50**	**13391**	**8978**	**1339**	**3074**	**34**
R6	**46**	**15076**	**10317**	**1508**	**3251**	**32**
R7	**47**	**16806**	**11470**	**1681**	**3655**	**32**

4.3 Current Load Due to Management Estimates

Estimates for hillslope sediment levels due to management activities and the increase over background due to management related activities can be made using a variety of models. Two of these include the draft SedMod (Boise Cascade, 1998) and BoiSed (Reining, el al, 1991). Neither of these two examine the effects of management activities on landslides, or incorporate increases to sediment loads due to fire, range, agriculture, or urban activities. Also, the estimates provided by these models are based on current sediment sources during average climatic conditions and, therefore, do not provide estimates of the current load being routed by the stream. The current sediment load estimates for both SedMod and BoiSed are presented in Tables 6 , 7, 8, and 9.

Table 6: SedMod Percent Above Background*

Sub-Watershed	Management (tonnes/yr; tons/yr)	Background (tonnes/yr: tons/yr)	Percent Above Background (%)
Upper Payette	170.3; 187.7	240.9; 265.5	71
Bull	1.4; 1.5	357.3; 393.9	0.4
Bridge-Bryon	213.9; 235.8	398.0; 438.7	54
Silver	151.5; 167.0	387.3; 426.9	39
Sixmile	562.0; 619.5	385.4; 424.8	146
Rattlesnake	66.7; 73.5	98.6; 108.7	68
Rocky Canyon	342.8; 377.9	436.6; 481.3	79
Bulldog	0.0; 0.0	214.5; 236.4	0
Lightning	29.1; 32.1	334.9; 369.2	9
Scriver	446.2; 491.9	451.6; 497.8	99
Pyle	579.8; 639.1	550.6; 606.9	105
Anderson	303.7; 334.8	533.2; 587.8	57

*Based on road surface erosion (management) and hillslope creep (background) only. Landslide inputs are not considered in this estimate.

Table 7: SedMod Percent Above Background Results by Reach

Reach	Management (tonnes/yr)	Background (tonnes/yr)	Percent Above Background (%)	Cumulative Percent Above Background (%)
R1	278.7	797.2	35	35
R2	107	199	54	39
R3	713.7	772.7	92	62
R4	238.1	316.9	75	64
R5	**200.5**	**767.7**	**26**	**54**
R6	**1026**	**1002.2**	**102**	**67**
R7	**303.7**	**533.2**	**57**	**65**

Table 8: BoiSed Percent Above Background*

Sub-Watershed	Management (tonnes/yr; tons/yr)	Background (tonnes/yr; tons/yr)	BoiSed Percent Above Background (%)
Upper Payette	159.9; 176.3	823.8; 908.1	19.4
Bull	5.2; 5.7	706.4; 778.7	0.7
Bridge-Bryon	229.0; 252.4	1038.3; 1144.5	22.1
Silver	120.9; 133.3	1110.0; 1223.6	10.9
Sixmile	1044.7; 1151.6	1809.3; 1994.4	57.7
Rattlesnake	35.7; 39.3	344.7; 380.0	10.3
Rocky Canyon	117.5; 129.5	831.9; 917.0	14.1
Bulldog	3.6; 3.9	517.4; 570.3	0.7
Lightning	94.4; 104.1	801.0; 882.9	11.8
Scriver	373.9; 412.1	864.1; 952.5	43.3
Pyle	164.8; 181.7	435.6; 480.2	37.8
Anderson	523.6; 577.2	1283.9; 1415.3	40.8

*Current sediment loads from USDA Forest Service managed lands only, Gravel and dirt roads grouped together.

Table 9: BoiSed Percent Above Background Results by Reach

Reach	Management (tons/yr)	Background (tons/yr)	Percent Above Background (%)	Cumulative Percent Above Background (%)
R1	308.2	2258.5	14	14
R2	126.2	572.3	22	15
R3	1284.9	3218.0	40	28
R4	104.1	838.5	12	26
R5	172.8	1911.7	9	23
R6	593.8	1432.7	41	25
R7	577.2	1415.3	41	27

In addition to these modeled results, a geomorphic risk assessment for sediment has also been conducted within the Middle Fork Payette River (Fitzgerald et al, 1998a). This assessment identified those sub-watersheds most likely to contain the largest amount of deliverable sediment. Sub-watersheds with high natural (i.e., background) sediment yields are Lightning, Big Bulldog and Groundhog. Pure sub-watersheds that are likely to deliver the largest anthropogenic sediment loads to the Middle Fork Payette River include: Anderson; Scriver; Lightning; Sixmile; West Fork; and Wet Foot. Composite sub-watersheds that have substantial anthropogenic sediment yields are: Pyle; Rocky Canyon; Bridge; and Groundhog. The geomorphic risk assessment also identifies those watersheds with a high risk for *internal* sediment problems due to anthropogenic sources. These watersheds include: Anderson; Scriver; Lightning; Sixmile; West Fork; Wet Foot; and Silver.

A cooperative sediment trend monitoring study with the EPA, IDEQ, and the USDA Forest Service is currently being conducted within the Middle Fork Payette River sub-basin. The results of this effort are helpful in quantifying streamflow and captured bedload particle sizes within the Middle Fork Payette River sub-basin. The draft report covering the 1998 data collection season presents bedload: discharge rating curves for two sites in the lower reaches of the Middle Fork Payette River based on 11 bedload samples. Estimates of the sediment load during the spring runoff period (late April through June) at these two sites indicate a load of 57.5 tons/mi^2 at the confluence with Lightning Creek and 88.5 tons/mi^2 at the site near the mouth. Note that these data show an estimated increase in bedload sediment production as the length of flow within the alluvial portion of the sub-basin increases, a condition highly unlikely in an agrading river system. Due to the preliminary nature of these values they were not used to validate the current sediment load as estimated by SedMod.

Table 10: Current Cumulative Sediment Loads, Cumulative Management Allocations, and Required Sediment Load Reductions*

Reach	Cumulative Current Load Estimate (% above bkgrnd)	Cumulative Management Allocation (% (above bkgrnd)	Required Sediment Load Reduction (% above bkgrnd)
R1	35	35	0
R2	39	34	5
R3	62	33	29
R4	64	33	31
R5	54	34	20
R6	67	32	35
R7	65	32	33

*Current load estimate for percent above background based on SedMod (Boise Cascade, 1998).

Transport capacity and reach deposition results for the seven reaches under background sediment input levels are presented in Table 11. Transport capacity and reach deposition results for the seven reaches under target sediment input levels are presented in Table 12.

Table 11a. Reach 1 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	16
Slope - S (m/m)	0.0101
Wetted Perimeter - P (m)	16.9
Cross Section Area to WS - A (m^2)	10.4
Hydraulic Radius - R (m)	0.62
Depth of Scour = 1/3 R	0.21
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	61.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.09877
Median Grain Size - d50 (mm)	77
Percent of Bed < 1.4 mm	4%
Percent of Bed < 2.8 mm	10%
Percent of Bed < 5.7 mm	14%
Percent of Bed < 11 mm	17%

GEOMETRY CHECK	
Manning's n	0.066
Flow (cms)	11.5
Adr (mi^2)	76.5
Flow (cms)	13.2
Percent Difference	-0.13

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	76.5
Bkgrnd (T/mi^2)	0.9
Mgmt (% abv Bkg)	0%
Mgmt (T/mi^2)	0.8
Background	71
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	11%	9.23
0.25	0.5	11%	9.23
0.5	1	11%	9.23
1	2	11%	9.23
2	4	16%	11.36
4	8	10%	7.10
8	16	6%	4.26
16	32	5%	3.55
32	64	5%	3.55
64	128	2%	1.42
128	256	2%	1.42
256	512	2%	1.42
		100%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.76E-02	3.76E-02	1.26479	0.03602	5.06E-05	0.00	2.14E+00	185

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vt (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi Qbi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	8.97E-05	370.366	1.1E+01	1.00E-02	176.214	1.38E-01	425.36	0.044	Yes
0.25	0.5	0.4	1.79E-04	260.200	1.1E+01	9.87E-03	175.001	1.37E-01	422.62	0.063	Yes
0.5	1	0.7	3.50E-04	123.699	1.1E+01	9.83E-03	172.596	1.34E-01	410.01	0.089	Yes
1	2	1.4	7.08E-04	67.128	1.1E+01	9.57E-03	167.882	1.30E-01	405.43	0.125	No
2	4	2.8	1.41E-03	33.708	1.0E+01	9.05E-03	158.792	1.42E-01	383.47	0.177	No
4	8	5.7	2.81E-03	16.922	9.0E+00	8.00E-03	141.830	1.27E-01	342.51	0.251	No
8	16	11	5.60E-03	8.496	7.1E+00	6.40E-03	112.260	1.00E-01	271.10	0.355	No
16	32	23	1.11E-02	4.266	4.3E+00	3.86E-03	67.727	6.06E-02	163.56	0.502	No
32	64	45	2.22E-02	2.142	1.3E+00	1.14E-03	20.085	1.80E-02	48.51	0.709	No
64	128	91	4.42E-02	1.075	6.9E-03	6.24E-06	0.110	9.80E-05	0.26	1.003	No
128	256	181	8.81E-02	0.540	3.1E-07	4.60E-10	0.000	7.23E-09	0.00	1.419	No
256	512	362	1.73E-01	0.271	5.8E-10	5.21E-13	0.000	8.10E-12	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Q/50	% of Bed From Particles in Motion	cumulative % in Bed	Approx. D50
0.2	0	9	Suspended	Suspended	9	0	Suspended	Suspended	Suspended	0%	
0.4	0	9	Suspended	Suspended	9	0	Suspended	Suspended	Suspended	0%	
0.7	0	9	Suspended	Suspended	9	0	Suspended	Suspended	Suspended	0%	
1.4	0	9	405	2.46	9	0	9.230	6.28E-06	4%	4%	
2.8	0	11	383	44	11	0	11.360	8.17E-06	6%	10%	
5.7	0	7	343	39	7	0	7.100	5.73E-06	4%	14%	
11.3	0	4	271	31	4	0	4.260	4.33E-06	3%	17%	
22.6	0	4	164	18	4	0	3.550	3.98E-06	4%	21%	
45.3	0	4	49	6	4	0	3.550	2.02E-05	14%	35%	D50 76.9 mm
90.5	0	1	0	0	0	1.4	0.030	3.16E-05	22%	57%	
181.0	0	1	0	0	0	1.4	0.000	3.16E-05	22%	78%	
362.0	0	1	0	0	0	1.4	0.000	3.16E-05	22%	100%	
			Total 1615			Total 4.2	% Cap Used 21%	Sum = 1.5E-04			

D50 76.1 mm

Table 11b. Reach 2 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	16
Slope - S (m/m)	0.0065
Wetted Perimeter - P (m)	16.3
Cross Section Area to WS - A (m^2)	11.5
Hydraulic Radius - R (m)	0.71
Depth of Scour = 1/3 R	0.24
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	45.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.08484
Median Grain Size - d50 (mm)	54
Percent of Bed < 1.4 mm	9%
Percent of Bed < 2.8 mm	15%
Percent of Bed < 5.7 mm	19%
Percent of Bed < 11 mm	22%

GEOMETRY CHECK	
Manning's n	0.06
Flow (cms)	12.2
Adr (mi^2)	90
Flow (cms)	16.2
Percent Difference	-0.25

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	13.5
Bkgrnd (T/mi^2)	0.7
Mgmt (% abv Bkg	0%
Mgmt (T/mi^2)	0.0
Background	10
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	1.30
0.25	0.5	13.00%	1.30
0.5	1	13.00%	1.30
1	2	13.00%	1.30
2	4	16.00%	1.60
4	8	10.00%	1.00
8	16	6.00%	0.60
16	32	5.00%	0.50
32	64	5.00%	0.50
64	128	2.00%	0.20
128	256	2.00%	0.20
256	512	2.00%	0.20
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.97E-02	3.76E-02	1.32126	0.09187	5.26E-05	0.00	2.29E+00	197

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi hi(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	1.27E-04	392.137	1.1E+01	6.33E-03	97.174	1.02E-01	275.05	0.044	Yes
0.25	0.5	0.4	2.52E-04	196.886	1.1E+01	6.29E-03	96.267	1.01E-01	273.37	0.063	Yes
0.5	1	0.7	5.03E-04	98.853	1.1E+01	6.17E-03	94.479	9.94E-02	268.29	0.089	No
1	2	1.4	1.00E-03	49.632	1.0E+01	5.94E-03	90.994	9.57E-02	258.40	0.125	No
2	4	2.8	1.99E-03	24.920	9.6E+00	5.31E-03	84.353	8.87E-02	239.54	0.177	No
4	8	5.7	3.97E-03	12.512	8.2E+00	4.72E-03	72.231	7.60E-02	205.17	0.251	No
8	16	11	7.91E-03	6.282	6.0E+00	3.41E-03	52.189	5.49E-02	148.28	0.355	No
16	32	23	1.58E-02	3.154	2.9E+00	1.65E-03	25.210	2.65E-02	71.39	0.502	No
32	64	45	3.14E-02	1.584	4.2E-01	2.41E-04	3.688	3.88E-03	10.47	0.709	No
64	128	91	6.25E-02	0.795	9.2E-05	5.28E-08	0.001	8.50E-07	0.00	1.003	No
128	256	181	1.24E-01	0.399	1.7E-08	9.90E-12	0.000	1.59E-10	0.00	1.419	No
256	512	362	2.48E-01	0.200	7.8E-11	4.45E-14	0.000	7.16E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	umulativ % in Bed	Approx D50
0.2	9	1	Suspended	Suspended	11	0	Suspended	Suspended	Suspende	0%	
0.4	9	1	Suspended	Suspended	11	0	Suspended	Suspended	Suspende	0%	
0.7	9	1	268	44	11	0	10.530	1.27E-05	4%	4%	
1.4	9	1	258	42	11	0	10.530	1.32E-05	4%	9%	
2.8	11	2	240	39	13	0	12.960	1.75E-05	6%	15%	
5.7	7	1	205	34	8	0	8.100	1.28E-05	4%	19%	
11.3	4	1	148	24	5	0	4.860	1.06E-05	4%	22%	
22.6	4	1	72	12	4	0	4.050	1.83E-05	6%	29%	
45.3	4	1	10	2	2	2	1.721	5.33E-05	18%	46%	54.3
90.5	0	0	0	0	0	0	0.000	5.33E-05	18%	64%	
181.0	0	0	0	0	0	0	0.000	5.33E-05	18%	82%	
362.0	0	0	0	0	0	0	0.000	5.33E-05	18%	100%	
			Total 1202			Total 3.0	% Cap Used: 11%	Sum = 3.0E-04			

54.3

Table 11c Reach 3 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	22
Slope - S (m/m)	0.00874
Wetted Perimeter - P (m)	22.4
Cross Section Area to WS - A (m^2)	19.6
Hydraulic Radius - R (m)	0.88
Depth of Scour = 1/3 R	0.29
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	75.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.10956
Median Grain Size -d50 (mm)	93
Percent of Bed < 1.4 mm	4%
Percent of Bed < 2.8 mm	9%
Percent of Bed < 5.7 mm	13%
Percent of Bed < 11 mm	16%

GEOMETRY CHECK	
Manning's n	0.035
Flow (cms)	30.5
Adr (mi^2)	170
Flow (cms)	36.7
Percent Difference	-0.17

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	80
Bkgrnd T/mi^2	0.7
Mgmt (% abv Bkg	0%
Mgmt (T/mi^2)	0.0
Background	53
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	6.89
0.25	0.5	13.00%	6.89
0.5	1	13.00%	6.89
1	2	13.00%	6.89
2	4	16.00%	8.48
4	8	10.00%	5.30
8	16	6.00%	3.18
16	32	5.00%	2.65
32	64	5.00%	2.65
64	128	2.00%	1.06
128	256	2.00%	1.06
256	512	2.00%	1.06
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.86E-02	3.76E-02	1.29314	0.07235	8.91E-05	0.00	5.27E+00	455

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*ph (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	7.46E-05	651.846	1.1E+01	1.37E-02	169.368	3.01E-01	811.38	0.044	Yes
0.25	0.5	0.4	1.49E-04	327.281	1.1E+01	1.36E-02	168.416	2.99E-01	806.82	0.063	Yes
0.5	1	0.7	2.96E-04	164.323	1.1E+01	1.35E-02	166.532	2.95E-01	797.79	0.089	Yes
1	2	1.4	5.89E-04	82.504	1.1E+01	1.33E-02	162.828	2.89E-01	780.05	0.125	No
2	4	2.8	1.17E-03	41.424	1.0E+01	1.26E-02	155.642	2.76E-01	745.62	0.177	No
4	8	5.7	2.34E-03	20.798	9.3E+00	1.15E-02	142.066	2.52E-01	680.59	0.251	No
8	16	11	4.66E-03	10.442	7.7E+00	9.54E-03	117.779	2.09E-01	564.23	0.355	No
16	32	23	9.27E-03	5.243	5.2E+00	6.41E-03	79.073	1.40E-01	378.81	0.502	No
32	64	45	1.85E-02	2.632	2.1E+00	2.56E-03	31.601	5.61E-02	151.39	0.709	No
64	128	91	3.68E-02	1.322	9.2E-02	1.14E-04	1.402	2.49E-03	6.72	1.003	No
128	256	181	7.33E-02	0.664	7.4E-06	9.08E-09	0.000	1.99E-07	0.00	1.419	No
256	512	362	1.46E-01	0.333	3.1E-09	3.84E-12	0.000	8.41E-11	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	Cumulative % in Bed	Approx D50
0.2	11	7	Suspended	Suspended	17	0	Suspended	Suspended	Suspended	0%	
0.4	11	7	Suspended	Suspended	17	0	Suspended	Suspended	Suspended	0%	
0.7	11	7	Suspended	Suspended	17	0	Suspended	Suspended	Suspended	0%	
1.4	11	7	780	107	17	0	17.420	1.22E-05	4%	4%	
2.8	13	8	746	109	21	0	21.440	1.57E-05	5%	9%	
5.7	8	5	681	94	13	0	13.400	1.08E-05	4%	13%	
11.3	5	3	564	78	8	0	8.040	7.79E-06	3%	16%	
22.6	4	3	379	52	7	0	6.700	9.67E-06	3%	19%	
45.3	2	3	151	21	4	0	4.371	1.58E-05	5%	24%	
90.5	0	1	7	1	1	0	0.925	7.53E-05	25%	49%	92.5
181.0	0	1	0	0	0	1	0.000	7.53E-05	25%	75%	
362.0	0	1	0	0	0	1	0.000	7.53E-05	25%	100%	
			Total 3307			Total 2.3	% Cap Used: 10%	Sum = 3.0E-04			

92.5

Table 11d: Reach 4 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS

Channel Width - w (m)	33
Slope - S (m/m)	0.01618
Wetted Perimeter - P (m)	33.3
Cross Section Area to WS - A (m^2)	19.1
Hydraulic Radius - R (m)	0.57
Depth of Scour = 1/3 R	0.19
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	91.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.12069
Median Grain Size - d50 (mm)	116
Percent of Bed < 1.4 mm	5%
Percent of Bed < 2.8 mm	11%
Percent of Bed < 5.7 mm	15%
Percent of Bed < 11 mm	18%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	47.9
Adr (m^2)	192
Flow (cms)	42.9
Percent Difference	0.12

TRIBUTARY INPUT TO REACH

Adr (mi^2)	11
Bkgrnd T/mi^2	1.9
Mgmt (% abv Bkg	0%
Mgmt (T/mi^2)	0.0
Background	21
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	2.70
0.25	0.5	13.00%	2.70
0.5	1	13.00%	2.70
1	2	13.00%	2.70
2	4	16.00%	3.33
4	8	10.00%	2.08
8	16	6.00%	1.25
16	32	5.00%	1.04
32	64	5.00%	1.04
64	128	2.00%	0.42
128	256	2.00%	0.42
256	512	2.00%	0.42
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.71E-02	3.76E-02	1.25367	0.05047	8.31E-05	0.00	7.41E+00	640

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi phi*w (m^3/s)	Potential Mass Qbi bi(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	5.97E-05	789.963	1.1E+01	1.84E-02	345.744	6.06E-01	1636.00	0.044	Yes
0.25	0.5	0.4	1.19E-04	396.829	1.1E+01	1.83E-02	344.140	6.03E-01	1628.46	0.063	Yes
0.5	1	0.7	2.37E-04	199.141	1.1E+01	1.81E-02	340.962	5.98E-01	1613.49	0.089	Yes
1	2	1.4	4.71E-04	99.985	1.1E+01	1.78E-02	334.701	5.87E-01	1583.80	0.125	No
2	4	2.8	9.39E-04	50.201	1.0E+01	1.71E-02	322.496	5.65E-01	1526.03	0.177	No
4	8	5.7	1.87E-03	25.205	9.6E+00	1.59E-02	299.221	5.24E-01	1415.91	0.251	No
8	16	11	3.72E-03	12.655	8.3E+00	1.36E-02	256.766	4.50E-01	1215.01	0.355	No
16	32	23	7.42E-03	6.354	6.0E+00	9.89E-03	186.227	3.26E-01	881.22	0.502	No
32	64	45	1.48E-02	3.190	2.9E+00	4.83E-03	90.883	1.59E-01	430.07	0.709	No
64	128	91	2.94E-02	1.602	4.5E-01	7.35E-04	13.840	2.43E-02	65.49	1.003	No
128	256	181	5.86E-02	0.804	1.1E-04	1.79E-07	0.003	5.91E-06	0.02	1.419	No
256	512	362	1.17E-01	0.404	1.9E-08	3.20E-11	0.000	1.06E-09	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	umulativ % in Bed	Approx D50
0.2	17	3	Suspended	Suspended	20	0	Suspended	Suspended	Suspende	0%	
0.4	17	3	Suspended	Suspended	20	0	Suspended	Suspended	Suspende	0%	
0.7	17	3	Suspended	Suspended	20	0	Suspended	Suspended	Suspende	0%	
1.4	17	3	1584	142	20	0	28.124	6.86E-06	5%	5%	
2.8	21	3	1526	137	25	0	24.768	8.77E-06	6%	11%	
5.7	13	2	1416	127	15	0	15.480	5.91E-06	4%	15%	
11.5	8	1	1215	109	9	0	9.288	4.13E-06	3%	18%	
22.6	7	1	881	79	8	0	7.740	4.74E-06	3%	21%	
45.3	4	1	430	39	5	0	5.411	6.80E-06	5%	26%	
90.5	1	0	65	6	1	0	1.341	1.13E-05	8%	33%	136.0
181.0	0	0	0	0	0	0	0.001	4.86E-05	33%	67%	
362.0	0	0	0	0	0	0	0.000	4.86E-05	33%	100%	
			Total 7118			Total 0.8	% Cap Used: 13%	Bmax = 1.5E-04			

113.8

Table 11a: Reach 5 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS

Channel Width - w (m)	25
Slope - S (m/m)	0.00309
Wetted Perimeter - P (m)	26.1
Cross Section Area to WS - A (m^2)	32.2
Hydraulic Radius - R (m)	1.23
Depth of Scour = 1/3 R	0.41
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	37.4
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.07735
Median Grain Size - d50 (mm)	42
Percent of Bed < 1.4 mm	8%
Percent of Bed < 2.8 mm	14%
Percent of Bed < 5.7 mm	18%
Percent of Bed < 11 mm	22%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	58.8
Adr (m^2)	245
Flow (cms)	58.6
Percent Difference	0.00

TRIBUTARY INPUT TO REACH

Adr (mi^2)	53
Bkgrnd T/mi^2	1.3
Mgmt (% abv Bkg	0%
Mgmt (T/mi^2)	0.0
Background	69
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	9.00
0.25	0.5	13.00%	9.00
0.5	1	13.00%	9.00
1	2	13.00%	9.00
2	4	16.00%	11.07
4	8	10.00%	6.92
8	16	6.00%	4.15
16	32	5.00%	3.46
32	64	5.00%	3.46
64	128	2.00%	1.38
128	256	2.00%	1.38
256	512	2.00%	1.38
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/t)	Qb total (m^3/t)	Qb total (kg/t)	For 2 year storm Qb total (Tonnes/yr)
5.40E-02	3.76E-02	1.43572	0.20887	9.06E-05	0.00	6.16E+00	535

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/t)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*rh (kg/t)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	1.65E-04	328.502	1.1E+01	4.80E-03	42.038	1.31E-01	328.74	0.044	Yes
0.25	0.5	0.4	3.29E-04	163.931	1.1E+01	4.73E-03	41.347	1.30E-01	323.08	0.063	Yes
0.5	1	0.7	6.56E-04	82.307	1.1E+01	4.64E-03	40.680	1.17E-01	315.87	0.089	No
1	2	1.4	1.31E-03	41.325	1.0E+01	4.44E-03	38.843	1.13E-01	301.90	0.125	No
2	4	2.8	2.60E-03	20.749	9.3E+00	4.07E-03	35.446	1.02E-01	275.30	0.177	No
4	8	5.7	5.18E-03	10.418	7.7E+00	3.36E-03	29.373	8.46E-02	228.30	0.251	No
8	16	11	1.03E-02	5.230	5.2E+00	2.25E-03	19.699	5.67E-02	153.11	0.355	No
16	32	23	2.06E-02	2.626	2.1E+00	8.97E-04	7.850	2.26E-02	61.01	0.502	No
32	64	45	4.09E-02	1.319	9.0E-02	3.90E-05	0.341	9.82E-04	2.65	0.709	No
64	128	91	8.15E-02	0.662	7.1E-06	3.09E-09	0.000	7.79E-08	0.00	1.003	No
128	256	181	1.62E-01	0.332	3.1E-09	1.32E-12	0.000	3.33E-11	0.00	1.419	No
256	512	362	3.23E-01	0.167	2.9E-11	1.20E-14	0.000	3.17E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	cumulativ % in Bed	Approx D50
0.2	20	9	Suspended	Suspended	29	0	Suspended	Suspended	Suspende	0%	
0.4	20	9	Suspended	Suspended	29	0	Suspended	Suspended	Suspende	0%	
0.7	20	9	316	126	29	0	29.120	8.18E-05	4%	4%	
1.4	20	9	302	120	29	0	29.120	8.56E-05	4%	8%	
2.8	25	11	276	110	36	0	35.840	1.15E-04	6%	14%	
5.7	15	7	228	91	22	0	22.400	8.71E-05	4%	18%	
11.3	9	4	153	61	13	0	13.440	7.75E-05	4%	22%	
22.6	8	3	61	24	11	0	11.200	1.43E-04	8%	30%	
45.3	5	3	3	1	1	8	1.015	3.53E-04	17%	48%	51.4
90.5	1	1	0	0	0	3	0.000	3.53E-04	17%	65%	
181.0	0	1	0	0	0	1	0.000	3.53E-04	17%	83%	
362.0	0	1	0	0	0	1	0.000	3.53E-04	17%	100%	
			Total 1338			Total 13.3	% Cap Used: [illegible]	Sum = [illegible]			

41.5

Table 11f Reach 6 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	38
Slope - S (m/m)	0.008
Wetted Perimeter - P (m)	39
Cross Section Area to WS - A (m^2)	71
Hydraulic Radius - R (m)	1.79
Depth of Scour = 1/3 R	0.60
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	17.6
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.05300
Median Grain Size - d50 (mm)	18
Percent of Bed < 1.4 mm	13%
Percent of Bed < 2.8 mm	20%
Percent of Bed < 5.7 mm	27%
Percent of Bed < 11 mm	38%

GEOMETRY CHECK	
Manning's n	0.035
Flow (cms)	93.9
Adr (m^2)	310
Flow (cms)	79.2
Percent Difference	0.19

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	65
Bkgrnd T/mi^2	0.8
Mgmt (% abv Bkg	0%
Mgmt (T/mi^2)	0.0
Background	53
Management	0

Input Particle Sizes min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	7.11
0.25	0.5	13.00%	7.11
0.5	1	13.00%	7.11
1	2	13.00%	7.11
2	4	16.00%	8.75
4	8	10.00%	5.47
8	16	6.00%	3.28
16	32	5.00%	2.74
32	64	5.00%	2.74
64	128	2.00%	1.09
128	256	2.00%	1.09
256	512	2.00%	1.09
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
5.81E-02	3.76E-02	1.54489	0.36443	5.08E-05	0.00	5.27E+00	455

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/s)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi' bi(vol)*sh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	3.77E-04	154.016	1.1E+01	1.52E-03	9.203	3.85E-02	138.08	0.044	Yes
0.25	0.5	0.4	7.51E-04	77.329	1.1E+01	1.49E-03	8.984	5.72E-02	154.35	0.063	No
0.5	1	0.7	1.50E-03	38.826	1.0E+01	1.42E-03	8.502	5.45E-02	147.07	0.089	No
1	2	1.4	2.98E-03	19.494	9.2E+00	1.29E-03	7.766	4.94E-02	133.40	0.125	No
2	4	2.8	5.93E-03	9.787	7.5E+00	1.05E-03	6.352	4.04E-02	109.12	0.177	No
4	8	5.7	1.18E-02	4.914	4.9E+00	6.85E-04	4.137	2.63E-02	71.06	0.251	No
8	16	11	2.35E-02	2.467	1.8E+00	2.52E-04	1.522	9.68E-03	26.15	0.355	No
16	32	23	4.69E-02	1.239	4.4E-02	6.10E-06	0.037	2.34E-04	0.63	0.502	No
32	64	45	9.34E-02	0.622	3.1E-06	4.32E-10	0.000	1.66E-08	0.00	0.709	No
64	128	91	1.86E-01	0.312	1.8E-09	2.48E-13	0.000	9.54E-12	0.00	1.003	No
128	256	181	3.70E-01	0.157	2.1E-11	3.00E-15	0.000	1.15E-13	0.00	1.419	No
256	512	362	7.38E-01	0.079	2.0E-12	2.76E-16	0.000	1.06E-14	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	cumulativ % in Bed	Approx. D50
0.2	29	7	Suspended	Suspended	36	0	Suspended	Suspended	Suspende	0%	
0.4	29	7	154	109	36	0	36.231	4.60E-04	4%	4%	
0.7	29	7	147	104	36	0	36.231	4.83E-04	4%	8%	
1.4	29	7	133	95	36	0	36.231	5.33E-04	5%	13%	
2.8	36	9	109	77	45	0	44.392	8.01E-04	7%	20%	
5.7	22	5	71	50	28	0	27.870	7.69E-04	7%	27%	
11.3	13	3	26	19	17	0	16.722	1.25E-03	11%	38%	D50 22.1 mm
22.6	11	3	1	0	0	13	0.449	1.39E-03	12%	51%	
45.3	1	3	0	0	0	4	0.000	1.39E-03	12%	63%	
90.5	0	1	0	0	0	1	0.000	1.39E-03	12%	75%	
181.0	0	1	0	0	0	1	0.000	1.39E-03	12%	88%	
362.0	0	1	0	0	0	1	0.000	1.39E-03	12%	100%	
			Total 642			Total 20.6	% Cap Used: 10%	Sum = 1.1E-02			

D50 18.1 mm

Table 11g. Reach 7 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	26.5
Slope - S (m/m)	0.00101
Wetted Perimeter - P (m)	28.2
Cross Section Area to WS - A (m^2)	47.5
Hydraulic Radius - R (m)	1.68
Depth of Scour = 1/3 R	0.56
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	16.7
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*b)(m/s)	0.05162
Median Grain Size - d50 (mm)	16
Percent of Bed < 1.4 mm	15%
Percent of Bed < 2.8 mm	23%
Percent of Bed < 5.7 mm	31%
Percent of Bed < 11 mm	42%

GEOMETRY CHECK	
Manning's n	0.027
Flow (cms)	79.2
Adr (mi^2)	343
Flow (cms)	89.7
Percent Difference	-0.12

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	31
Bkgrnd T/mi^2	2.2
Mgmt (% abv Bkg)	0%
Mgmt (T/mi^2)	0.0
Background	68
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	8.84
0.25	0.5	13.00%	8.84
0.5	1	13.00%	8.84
1	2	13.00%	8.84
2	4	16.00%	10.88
4	8	10.00%	6.80
8	16	6.00%	4.08
16	32	5.00%	3.40
32	64	5.00%	3.40
64	128	2.00%	1.36
128	256	2.00%	1.36
256	512	2.00%	1.36
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
6.43E-02	3.76E-02	1.71049	0.38764	7.60E-05	0.00	1.44E+00	470

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*b?)
0.125	0.25	0.2	4.39E-04	146.569	1.1E+01	1.41E-03	9.032	3.74E-02	101.01	0.014	Yes
0.25	0.5	0.4	8.74E-04	73.588	1.1E+01	1.38E-03	8.826	3.65E-02	98.49	0.043	No
0.5	1	0.7	1.74E-03	36.948	1.0E+01	1.31E-03	8.390	3.47E-02	93.65	0.080	No
1	2	1.4	3.47E-03	18.554	9.1E+00	1.18E-03	7.371	3.13E-02	84.49	0.125	No
2	4	2.8	6.91E-03	9.314	7.4E+00	9.55E-04	6.100	2.53E-02	68.36	0.177	No
4	8	5.7	1.38E-02	4.676	4.7E+00	6.07E-04	3.890	1.61E-02	43.41	0.251	No
8	16	11	2.74E-02	2.348	1.6E+00	2.08E-04	1.335	5.52E-03	14.96	0.355	No
16	32	23	5.46E-02	1.179	2.4E-02	3.05E-06	0.020	8.07E-05	0.22	0.502	No
32	64	45	1.09E-01	0.592	1.4E-06	2.10E-10	0.000	5.56E-09	0.00	0.709	No
64	128	91	2.16E-01	0.297	1.2E-09	1.53E-13	0.000	4.05E-12	0.00	1.003	No
128	256	181	4.31E-01	0.149	1.7E-11	2.22E-15	0.000	5.87E-14	0.00	1.419	No
256	512	362	8.58E-01	0.075	1.8E-12	2.27E-16	0.000	6.01E-15	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Q/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
0.2	36	9	Suspended	Suspended	45	0	Suspended	Suspended	Suspende	0%	
0.4	36	9	98	115	45	0	45.071	5.83E-04	5%	5%	
0.7	36	9	84	109	43	0	45.071	6.13E-04	5%	9%	
1.4	36	9	84	98	45	0	45.071	6.80E-04	5%	15%	
2.8	45	11	68	80	55	0	55.472	1.03E-03	8%	23%	
5.7	28	7	43	51	35	0	34.470	1.02E-03	8%	31%	
11.3	17	4	15	17	17	3	17.344	1.48E-03	12%	43%	
22.6	0	3	0	0	0	4	0.234	1.48E-03	12%	54%	19.0
45.3	0	3	0	0	0	3	0.000	1.48E-03	12%	65%	
90.5	0	1	0	0	0	1	0.000	1.48E-03	12%	77%	
181.0	0	1	0	0	0	1	0.000	1.48E-03	12%	88%	
362.0	0	1	0	0	0	1	0.000	1.48E-03	12%	100%	
			Total 403			Total 14.3	% Cap Used: [illegible]	Sum = 1.1E-02			13.6

Table 12a. Reach 1 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	16
Slope - S (m/m)	0.0101
Wetted Perimeter - P (m)	16.9
Cross Section Area to WS - A (m^2)	10.4
Hydraulic Radius - R (m)	0.62
Depth of Scour = 1/3 R	0.21
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	61.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.09877
Median Grain Size -d50 (mm)	75
Percent of Bed < 1.4 mm	4%
Percent of Bed < 2.8 mm	8%
Percent of Bed < 5.7 mm	14%
Percent of Bed < 11 mm	18%

GEOMETRY CHECK	
Manning's n	0.066
Flow (cms)	11.5
Adr (m^2)	76.5
Flow (cms)	13.2
Percent Difference	-0.13

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	76.5
Bkgrnd (T/mi^2)	0.9
Mgmt (% abv Bkg	50%
Mgmt (T/mi^2)	0.5
Background	71
Management	36

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13%	13.85
0.25	0.5	13%	13.85
0.5	1	13%	13.85
1	2	13%	13.85
2	4	10%	10.65
4	8	16%	17.04
8	16	6%	6.39
16	32	5%	5.33
32	64	5%	5.33
64	128	2%	2.13
128	256	2%	2.13
256	512	2%	2.13
		100%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.91E-02	3.76E-02	1.30519	0.08029	7.25E-05	0.00	3.07E+00	2.65E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass - Qbi Qbi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	9.25E-05	530.466	1.1E+01	1.00E-02	176.219	1.58E-01	425.56	0.044	Yes
0.25	0.5	0.4	1.84E-04	266.339	1.1E+01	9.97E-03	175.002	1.57E-01	422.62	0.063	Yes
0.5	1	0.7	3.67E-04	133.724	1.1E+01	9.83E-03	172.597	1.54E-01	416.81	0.089	Yes
1	2	1.4	7.31E-04	67.141	1.1E+01	9.57E-03	167.884	1.50E-01	405.43	0.125	No
2	4	2.8	1.46E-03	33.710	1.0E+01	9.05E-03	158.795	1.42E-01	383.48	0.177	No
4	8	5.7	2.90E-03	16.925	9.0E+00	8.08E-03	141.836	1.27E-01	342.53	0.251	No
8	16	11	5.77E-03	8.498	7.1E+00	6.40E-03	112.270	1.00E-01	271.13	0.355	No
16	32	23	1.15E-02	4.267	4.3E+00	3.86E-03	67.741	6.06E-02	163.59	0.502	No
32	64	45	2.29E-02	2.142	1.3E+00	1.15E-03	20.096	1.80E-02	48.53	0.709	No
64	128	91	4.56E-02	1.076	6.9E-03	6.26E-06	0.110	9.83E-05	0.27	1.003	No
128	256	181	9.09E-02	0.540	5.1E-07	4.62E-10	0.000	7.25E-09	0.00	1.419	No
256	512	362	1.81E-01	0.271	5.8E-10	5.22E-13	0.000	8.19E-12	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
0.2	0	14	Suspended	Suspended	14	0	Suspended	Suspended	Suspended	0%	
0.4	0	14	Suspended	Suspended	14	0	Suspended	Suspended	Suspended	0%	
0.7	0	14	Suspended	Suspended	14	0	Suspended	Suspended	Suspended	0%	
1.4	0	14	405	67	14	0	13.845	9.41E-06	4%	4%	
2.8	0	11	383	63	11	0	10.650	7.66E-06	4%	8%	
5.7	0	17	343	56	17	0	17.040	1.37E-05	6%	14%	
11.3	0	6	271	45	6	0	6.390	6.50E-06	3%	18%	
22.6	0	5	164	27	5	0	5.325	8.97E-06	4%	22%	
45.3	0	5	49	8	5	0	5.325	3.02E-05	14%	36%	75
90.5	0	2	0	0	0	2	0.044	4.53E-05	21%	57%	
181.0	0	2	0	0	0	2	0.000	4.53E-05	21%	79%	
362.0	0	2	0	0	0	2	0.000	4.53E-05	21%	100%	
			Total 1615			Total 6.3	% Cap Used: 22%	Sum = 2.1E-04			

D50 75 mm

Table 12b. Reach 2 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS

Channel Width - w (m)	16
Slope - S (m/m)	0.0065
Wetted Perimeter - P (m)	16.3
Cross Section Area to WS - A (m^2)	11.5
Hydraulic Radius - R (m)	0.71
Depth of Scour = 1/3 R	0.24
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	45.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.06484
Median Grain Size -d50 (mm)	52
Percent of Bed < 1.4 mm	9%
Percent of Bed < 2.8 mm	13%
Percent of Bed < 5.7 mm	20%
Percent of Bed < 11 mm	23%

GEOMETRY CHECK

Manning's n	0.06
Flow (cms)	12.2
Adr (mi^2)	90
Flow (cms)	16.2
Percent Difference	-0.25

TRIBUTARY INPUT TO REACH

Adr (mi^2)	25.5
Bkgrnd (T/mi^2)	0.7
Mgmt (% abv Bkg)	44%
Mgmt (T/mi^2)	0.3
Background	10
Management	4

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	1.87
0.25	0.5	13.00%	1.87
0.5	1	13.00%	1.87
1	2	13.00%	1.87
2	4	10.00%	1.44
4	8	16.00%	2.30
8	16	6.00%	0.86
16	32	5.00%	0.72
32	64	5.00%	0.72
64	128	2.00%	0.29
128	256	2.00%	0.29
256	512	2.00%	0.29
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm: Qb total (Tonnes/yr)
5.14E-02	3.76E-02	1.36786	0.13217	7.36E-05	0.00	3.39E+00	2.84E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi Vi(rs)*w (kg/s)	Particle Fall Velocity Wi (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	1.31E-04	392.218	1.1E+01	6.33E-03	97.375	1.02E-01	275.91	0.044	Yes
0.25	0.5	0.4	2.61E-04	196.926	1.1E+01	6.29E-03	96.263	1.01E-01	273.37	0.065	Yes
0.5	1	0.7	5.20E-04	98.874	1.1E+01	6.17E-03	94.479	9.94E-02	268.38	0.089	No
1	2	1.4	1.04E-03	49.643	1.0E+01	5.94E-03	90.906	9.57E-02	258.48	0.125	No
2	4	2.8	2.06E-03	24.925	9.6E+00	5.51E-03	84.358	8.87E-02	239.55	0.177	No
4	8	5.7	4.11E-03	12.514	8.2E+00	4.72E-03	72.250	7.60E-02	205.19	0.251	No
8	16	11	8.19E-03	6.283	6.0E+00	3.41E-03	52.196	5.49E-02	148.22	0.355	No
16	32	23	1.63E-02	3.155	2.9E+00	1.65E-03	25.216	2.65E-02	71.61	0.502	No
32	64	45	3.25E-02	1.584	4.2E-01	2.41E-04	3.692	3.88E-03	10.48	0.709	No
64	128	91	6.47E-02	0.795	9.3E-05	5.30E-08	0.001	8.53E-07	0.00	1.003	No
128	256	181	1.29E-01	0.399	1.7E-08	9.92E-12	0.000	1.60E-10	0.00	1.419	No
256	512	362	2.57E-01	0.200	7.8E-11	4.45E-14	0.000	7.17E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Q/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx. D50
0.2	14	2	Suspended	Suspended	16	0	Suspended	Suspended	Suspende	9%	
0.4	14	2	Suspended	Suspended	16	0	Suspended	Suspended	Suspende	9%	
0.7	14	2	268	63	16	0	15.217	1.90E-05	4%	4%	
1.4	14	2	258	61	16	0	15.717	1.97E-05	5%	9%	
2.8	11	1	240	57	12	0	12.890	1.64E-05	4%	13%	
5.7	17	2	205	48	19	0	19.344	3.06E-05	7%	20%	
11.3	6	1	148	35	7	0	7.254	1.39E-05	4%	23%	
22.6	5	1	72	17	6	0	6.065	2.74E-05	6%	30%	
45.3	5	1	10	2	2	4	2.478	7.00E-05	18%	47%	52
90.5	0	0	0	0	0	0	0.001	7.66E-05	18%	65%	
181.0	0	0	0	0	0	0	0.000	7.66E-05	18%	82%	
362.0	0	0	0	0	0	0	0.000	7.66E-05	18%	100%	
			Total 1202			Total 4.5	% Cap Used: 22%	Sum = 4.0E-04			

D50 52 mm

Table 12c Reach 3 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	22
Slope - S (m/m)	0.00874
Wetted Perimeter - P (m)	22.4
Cross Section Area to WS - A (m^2)	19.6
Hydraulic Radius - R (m)	0.88
Depth of Scour = 1/3 R	0.29
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - τb (Pa)	75.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.10956
Median Grain Size - d50 (mm)	90
Percent of Bed < 1.4 mm	4%
Percent of Bed < 2.8 mm	8%
Percent of Bed < 5.7 mm	14%
Percent of Bed < 11 mm	17%

GEOMETRY CHECK	
Manning's n	0.035
Flow (user)	30.5
Adr (mi^2)	170
Flow (calc)	36.7
Percent Difference	-0.17

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	90
Bkgrnd T/mi^2	0.7
Mgmt (% abv Bkg)	[illegible]
Mgmt (T/mi^2)	[illegible]
Background	[illegible]
Management	28

Input Particle Sizes min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	10.27
0.25	0.5	13.00%	10.27
0.5	1	13.00%	10.27
1	2	13.00%	10.27
2	4	10.00%	7.90
4	8	16.00%	12.64
8	16	6.00%	4.74
16	32	5.00%	3.95
32	64	5.00%	3.95
64	128	2.00%	1.58
128	256	2.00%	1.58
256	512	2.00%	1.58
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

τ*median (dimless)	τ*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
5.01E-02	3.76E-02	1.33202	0.10028	1.34E-04	0.00	7.31E+00	6.31E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	τ*ri ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume QbI qbi*w (m^3/s)	Potential Mass QbI M(ro)Q*vk (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	7.68E-05	651.902	1.1E+01	1.37E-02	[illegible]	3.01E-01	813.38	0.044	Yes
0.25	0.5	0.4	1.53E-04	327.339	1.1E+01	1.36E-02	166.417	2.99E-01	808.82	0.063	Yes
0.5	1	0.7	3.05E-04	164.332	1.1E+01	1.35E-02	164.333	2.95E-01	797.80	0.089	Yes
1	2	1.4	6.07E-04	82.518	1.1E+01	1.31E-02	162.829	2.89E-01	780.06	0.125	No
2	4	2.8	1.21E-03	41.431	1.0E+01	1.26E-02	155.645	2.76E-01	745.64	0.177	No
4	8	5.7	2.41E-03	20.803	9.3E+00	1.15E-02	142.871	2.52E-01	680.61	0.251	No
8	16	11	4.80E-03	10.444	7.7E+00	9.54E-03	117.787	2.09E-01	564.27	0.355	No
16	32	23	9.55E-03	5.246	5.2E+00	6.41E-03	79.085	1.40E-01	378.07	0.502	No
32	64	45	1.90E-02	2.633	2.1E+00	2.56E-03	31.615	5.61E-02	151.45	0.709	No
64	128	91	3.79E-02	1.322	9.2E-02	1.14E-04	1.405	2.49E-03	6.73	1.003	No
128	256	181	7.55E-02	0.664	7.4E-06	9.10E-09	0.000	1.99E-07	0.00	1.419	No
256	512	362	1.50E-01	0.333	3.1E-09	3.83E-12	0.000	8.42E-11	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mean/velocity Q/V5	% of Bed From Particles in Motion	Cumulative % in Bed	Approx. D50
0.2	16	10	Suspended	Suspended	26	0	Suspended	Suspended	Suspended	0%	
0.4	16	10	Suspended	Suspended	26	0	Suspended	Suspended	Suspended	0%	
0.7	16	10	Suspended	Suspended	26	0	Suspended	Suspended	Suspended	0%	
1.4	16	10	780	149	26	0	21.982	1.83E-05	4%	4%	
2.8	12	8	746	142	28	0	19.987	1.47E-05	3%	8%	
5.7	19	13	681	130	32	0	31.979	2.57E-05	6%	14%	
11.3	7	5	564	108	12	0	11.992	1.16E-05	3%	17%	
22.6	6	4	379	72	10	0	9.994	1.44E-05	3%	20%	
45.3	2	4	151	29	6	0	6.496	2.32E-05	6%	26%	D50 89.8 mm
90.5	0	2	7	1	1	0	1.384	1.04E-04	25%	50%	
181.0	0	2	0	0	0	2	0.000	1.04E-04	25%	75%	
362.0	0	2	0	0	0	2	0.000	1.04E-04	25%	100%	
			Total 3308			Total 3.45	% Cap Used 17%	Sum = 4.3E-04			

D50 89.8 mm

Table 12d: Reach 4 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS

Channel Width - w (m)	33
Slope - S (m/m)	0.01618
Wetted Perimeter - P (m)	33.3
Cross Section Area to WS - A (m^2)	19.1
Hydraulic Radius - R (m)	0.57
Depth of Scour = 1/3 R	0.19
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	91.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.12069
Median Grain Size -d50 (mm)	113
Percent of Bed < 1.4 mm	5%
Percent of Bed < 2.8 mm	9%
Percent of Bed < 5.7 mm	16%
Percent of Bed < 11 mm	19%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	47.9
Adc (m^2)	192
Flow (tms)	42.9
Percent Difference	0.12

TRIBUTARY INPUT TO REACH

Adc (mi^2)	11
Bkgrnd T/mi^2	1.9
Mgmt (% abv Bkg	50%
Mgmt (T/mi^2)	0.9
Background	21
Management	10

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	4.06
0.25	0.5	13.00%	4.06
0.5	1	13.00%	4.06
1	2	13.00%	4.06
2	4	10.00%	3.12
4	8	16.00%	4.99
8	16	6.00%	1.87
16	32	5.00%	1.56
32	64	5.00%	1.56
64	128	2.00%	0.62
128	256	2.00%	0.62
256	512	2.00%	0.62
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.85E-02	3.76E-02	1.29056	0.07072	1.16E-04	0.00	1.84E+01	8.97E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi bi*w (m^3/s)	Potential Mass Qbi bi(rhos)*ch (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	6.14E-05	790.103	1.1E+01	1.84E-02	343.745	6.06E-01	1630.06	0.044	Yes
0.25	0.5	0.4	1.22E-04	396.690	1.1E+01	1.83E-02	344.141	6.03E-01	1628.47	0.083	Yes
0.5	1	0.7	2.44E-04	199.175	1.1E+01	1.81E-02	340.963	5.98E-01	1613.43	0.089	Yes
1	2	1.4	4.85E-04	100.003	1.1E+01	1.78E-02	334.703	5.87E-01	1583.81	0.125	No
2	4	2.8	9.66E-04	50.210	1.0E+01	1.71E-02	322.500	5.65E-01	1526.07	0.177	No
4	8	5.7	1.92E-03	25.210	9.6E+00	1.59E-02	299.229	5.24E-01	1415.95	0.251	No
8	16	11	3.83E-03	12.657	8.3E+00	1.36E-02	256.780	4.50E-01	1215.08	0.355	No
16	32	23	7.64E-03	6.355	6.9E+00	9.39E-03	186.249	3.26E-01	881.33	0.502	No
32	64	45	1.52E-02	3.191	2.9E+00	4.83E-03	90.909	1.59E-01	430.18	0.709	No
64	128	91	3.03E-02	1.602	4.5E-01	7.36E-04	13.851	2.43E-02	65.54	1.003	No
128	256	181	6.03E-02	0.804	1.1E-04	1.79E-07	0.003	5.92E-06	0.02	1.419	No
256	512	362	1.20E-01	0.404	1.9E-08	3.21E-11	0.000	1.06E-09	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocit Qi/Vi	% of Bed From Particles in Motion	cumulativ % in Bed	Approx D50
0.2	26	4	Suspended	Suspended	30	0	Suspended	Suspended	Suspende	0%	
0.4	26	4	Suspended	Suspended	30	0	Suspended	Suspended	Suspende	0%	
0.7	26	4	Suspended	Suspended	30	0	Suspended	Suspended	Suspende	0%	
1.4	26	4	1584	200	30	0	30.039	1.02E-05	5%	5%	
2.8	20	3	1526	193	23	0	23.107	8.18E-06	4%	9%	
5.7	32	5	1416	178	37	0	36.971	1.41E-05	7%	16%	
11.3	12	2	1215	153	14	0	13.864	6.16E-06	3%	19%	
22.6	10	2	881	111	12	0	11.554	7.08E-06	3%	22%	
45.3	6	2	430	54	8	0	7.986	1.00E-05	5%	27%	
90.5	1	1	66	8	2	0	1.908	1.57E-05	8%	34%	133
181.0	0	1	0	0	0	1	0.002	6.81E-05	33%	67%	
362.0	0	1	0	0	0	1	0.000	6.81E-05	33%	100%	
			Total 7118			Total 1.2	############	Qsm = 1.1E-04			

D50 113 mm

Table 12c: Reach 5 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS

Channel Width - w (m)	25
Slope - S (m/m)	0.00309
Wetted Perimeter - P (m)	26.1
Cross Section Area to WS - A (m^2)	32.2
Hydraulic Radius - R (m)	1.23
Depth of Scour = 1/3 R	0.41
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	37.4
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.07735
Median Grain Size - d50 (mm)	40
Percent of Bed < 1.4 mm	9%
Percent of Bed < 2.8 mm	12%
Percent of Bed < 5.7 mm	20%
Percent of Bed < 11 mm	24%

GEOMETRY CHECK

Manning's n	0.036
Flow (cms)	58.8
Adr (m^2)	268
Flow (cms)	58.6
Percent Difference	0.00

TRIBUTARY INPUT TO REACH

Adr (mi^2)	33
Bkgrnd T/mi^2	1.3
Mgmt (% abv Bkg	56%
Mgmt (T/mi^2)	0.7
Background	69
Management	39

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	14.03
0.25	0.5	13.00%	14.03
0.5	1	13.00%	14.03
1	2	13.00%	14.03
2	4	10.00%	10.80
4	8	16.00%	17.27
8	16	6.00%	6.48
16	32	5.00%	5.40
32	64	5.00%	5.40
64	128	2.00%	2.16
128	256	2.00%	2.16
256	512	2.00%	2.16
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
5.63E-02	3.76E-02	1.49849	0.39353	1.28E-04	0.00	8.72E+00	7.53E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi M*w (m^3/s)	Potential Mass Qbi bi(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	1.73E-04	326.586	1.1E+01	4.80E-03	42.039	1.21E-01	326.74	0.044	Yes
0.25	0.5	0.4	3.44E-04	163.973	1.1E+01	4.73E-03	41.547	1.20E-01	325.06	0.063	Yes
0.5	1	0.7	6.84E-04	82.328	1.1E+01	4.64E-03	40.641	1.17E-01	319.38	0.089	No
1	2	1.4	1.36E-03	41.336	1.0E+01	4.44E-03	38.843	1.12E-01	301.91	0.125	No
2	4	2.8	2.71E-03	20.754	9.3E+00	4.05E-03	35.448	1.02E-01	275.52	0.177	No
4	8	5.7	5.41E-03	10.420	7.7E+00	3.34E-03	29.376	8.46E-02	228.32	0.251	No
8	16	11	1.08E-02	5.232	5.3E+00	2.25E-03	19.703	5.67E-02	153.14	0.355	No
16	32	23	2.14E-02	2.627	2.1E+00	8.97E-04	7.854	2.26E-02	61.04	0.502	No
32	64	45	4.37E-02	1.319	9.0E-02	3.91E-05	0.342	9.85E-04	2.66	0.709	No
64	128	91	8.51E-02	0.662	7.2E-06	3.10E-09	0.000	7.82E-08	0.00	1.003	No
128	256	181	1.69E-01	0.332	3.1E-09	1.33E-12	0.000	3.34E-11	0.00	1.419	No
256	512	362	3.38E-01	0.167	2.9E-11	1.26E-14	0.000	3.18E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocit Qi/Vi	% of Bed From Particles in Motion	cumulativ % in Bed	Approx D50
0.2	30	14	Suspended	Suspended	44	0	Suspended	Suspended	Suspende	0%	
0.4	30	14	Suspended	Suspended	44	0	Suspended	Suspended	Suspende	0%	
0.7	30	14	316	178	44	0	44.073	1.24E-04	4%	4%	
1.4	30	14	302	170	44	0	44.073	1.30E-04	4%	9%	
2.8	23	11	276	155	34	0	33.902	1.09E-04	4%	12%	
5.7	37	17	228	129	54	0	54.244	2.11E-04	7%	20%	
11.3	14	6	153	86	20	0	20.341	1.18E-04	4%	24%	
22.6	12	5	61	34	17	0	16.951	2.46E-04	8%	32%	
45.3	8	5	3	1	1	12	1.496	4.99E-04	17%	49%	40
90.5	2	2	0	0	0	4	0.000	4.99E-04	17%	66%	
181.0	0	2	0	0	0	2	0.000	4.99E-04	17%	83%	
362.0	0	2	0	0	0	2	0.000	4.99E-04	17%	100%	
			Total 1338			Total 20.3	% Cap Used: 23%	Sum = 2.9E-03			

D50 40 mm

Table 12f: Reach 6 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	38
Slope - S (m/m)	0.001
Wetted Perimeter - P (m)	39
Cross Section Area to WS - A (m^2)	71
Hydraulic Radius - R (m)	1.79
Depth of Scour = 1/3 R	0.60
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	17.6
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.05100
Median Grain Size - d50 (mm)	17
Percent of Bed < 1.4 mm	13%
Percent of Bed < 2.8 mm	18%
Percent of Bed < 5.7 mm	29%
Percent of Bed < 11 mm	41%

GEOMETRY CHECK	
Manning's n	0.035
Flow (cms)	93.9
Adr (mi^2)	310
Flow (cms)	79.2
Percent Difference	0.19

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	45
Bkgrnd T/mi^2	0.8
Mgmt (% abv Bkg	25%
Mgmt (T/mi^2)	0.2
Background	35
Management	14

Input Particle Sizes min (mm)	max (mm)	Percentage (wt)	Tonnes/yr
0.125	0.25	13.00%	8.92
0.25	0.5	13.00%	8.92
0.5	1	13.00%	8.92
1	2	13.00%	8.92
2	4	10.00%	6.86
4	8	16.00%	10.98
8	16	6.00%	4.12
16	32	5.00%	3.43
32	64	5.00%	3.43
64	128	2.00%	1.37
128	256	2.00%	1.37
256	512	2.00%	1.37
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

I*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
6.19E-02	3.74E-02	1.64667	0.50184	7.00E-03	0.00	7.28E+00	6.27E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi bi*w (m^3/s)	Potential Mass Qbi M(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k)
0.125	0.25	0.2	4.07E-04	154.075	1.1E+01	1.52E-03	9.300	5.85E-02	158.09	0.044	Yes
0.25	0.5	0.4	8.00E-04	77.359	1.1E+01	1.49E-03	8.985	5.72E-02	154.39	0.063	No
0.5	1	0.7	1.59E-03	38.841	1.0E+01	1.42E-03	8.502	5.45E-02	147.07	0.089	No
1	2	1.4	3.17E-03	19.501	9.2E+00	1.29E-03	7.766	4.94E-02	133.41	0.125	No
2	4	2.8	6.32E-03	9.791	7.3E+00	1.05E-03	6.353	4.04E-02	109.14	0.177	No
4	8	5.7	1.26E-02	4.916	4.9E+00	6.86E-04	4.138	2.63E-02	71.08	0.251	No
8	16	11	2.51E-02	2.468	1.8E+00	2.52E-04	1.524	9.69E-03	26.17	0.355	No
16	32	23	5.00E-02	1.239	4.4E-02	6.13E-06	0.037	2.35E-04	0.64	0.502	No
32	64	45	9.98E-02	0.622	3.1E-06	4.34E-10	0.000	1.67E-08	0.00	0.709	No
64	128	91	1.98E-01	0.312	1.8E-09	2.49E-13	0.000	9.57E-12	0.00	1.003	No
128	256	181	3.95E-01	0.157	2.2E-11	3.00E-15	0.000	1.15E-13	0.00	1.419	No
256	512	362	7.88E-01	0.079	2.0E-12	2.76E-16	0.000	1.06E-14	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocit Qi/Vi	% of Bed From Particles in Motion	cumulativ % in Bed	Approx D50
0.2	44	9	Suspended	Suspended	53	0	Suspended	Suspended	Suspende	0%	
0.4	44	9	154	151	53	0	52.997	6.73E-04	4%	4%	
0.7	44	9	147	144	53	0	52.997	7.07E-04	4%	9%	
1.4	44	9	133	130	53	0	52.997	7.79E-04	5%	13%	
2.8	34	7	109	107	41	0	40.767	7.32E-04	5%	18%	
5.7	54	11	71	69	65	0	65.227	1.80E-03	11%	29%	
11.3	20	4	26	26	24	0	24.460	1.83E-03	11%	41%	20
22.6	17	3	1	1	1	20	0.620	1.92E-03	12%	52%	
45.3	1	3	0	0	0	5	0.000	1.92E-03	12%	64%	
90.5	0	2	0	0	0	1	0.000	1.92E-03	12%	76%	
181.0	0	1	0	0	0	1	0.000	1.92E-03	12%	88%	
362.0	0	1	0	0	0	1	0.000	1.92E-03	12%	100%	
			Total 642			Total 28.8	% Cap Used: 19%	Sum = 1.6E-02			

D50 17 mm

Table 12g: Reach 7 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	26.5
Slope - S (m/m)	0.00101
Wetted Perimeter - P (m)	28.2
Cross Section Area to WS - A (m^2)	47.5
Hydraulic Radius - R (m)	1.68
Depth of Scour = 1/3 R	0.56
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	16.7
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*)(m/s)	0.05167
Median Grain Size -d50 (mm)	15
Percent of Bed < 1.4 mm	16%
Percent of Bed < 2.8 mm	21%
Percent of Bed < 5.7 mm	33%
Percent of Bed < 11 mm	44%

GEOMETRY CHECK	
Manning's n	0.027
Flow (cms)	79.2
Adr (m^2)	341
Flow (cms)	89.4
Percent Difference	-0.12

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	31
Bkgrnd T/mi^2	2.2
Mgmt (% abv Bkg	48%
Mgmt (T/mi^2)	1.1
Background	68
Management	33

Input Particle Sizes min (mm)	max (mm)	Percentage (bin)	Tonnes/yr
0.125	0.25	13.00%	13.12
0.25	0.5	13.00%	13.12
0.5	1	13.00%	13.12
1	2	13.00%	13.12
2	4	10.00%	10.09
4	8	16.00%	16.15
8	16	6.00%	6.05
16	32	5.00%	5.05
32	64	5.00%	5.05
64	128	2.00%	2.02
128	256	2.00%	2.02
256	512	2.00%	2.02
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
6.90E-02	3.76E-02	1.83553	0.77567	1.00E-04	0.00	7.16E+00	6.18E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/s)	Parker Potential Volume Qbi bi*w (m^3/s)	Potential Mass Qbi bi(wsd)*ih (kg/s)	Particle Fall Velocity Wi (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	4.71E-04	146.829	1.1E+01	1.41E-03	9.032	3.74E-02	101.01	0.044	Yes
0.25	0.5	0.4	9.37E-04	73.630	1.1E+01	1.38E-03	8.828	3.65E-02	98.50	0.063	No
0.5	1	0.7	1.87E-03	36.963	1.0E+01	1.31E-03	8.399	3.47E-02	93.63	0.089	No
1	2	1.4	3.73E-03	18.559	9.1E+00	1.18E-03	7.572	3.13E-02	84.49	0.125	No
2	4	2.8	7.41E-03	9.318	7.4E+00	9.56E-04	6.127	2.53E-02	68.37	0.177	No
4	8	5.7	1.48E-02	4.678	4.7E+00	6.07E-04	3.891	1.61E-02	43.43	0.251	No
8	16	11	2.94E-02	2.349	1.6E+00	2.08E-04	1.337	5.52E-03	14.92	0.355	No
16	32	23	5.85E-02	1.179	2.4E-02	3.06E-06	0.020	8.11E-05	0.22	0.502	No
32	64	45	1.17E-01	0.592	1.0E-06	2.11E-10	0.000	5.59E-09	0.00	0.709	No
64	128	91	2.32E-01	0.297	1.2E-09	1.53E-13	0.000	4.07E-12	0.00	1.003	No
128	256	181	4.62E-01	0.149	1.7E-11	2.22E-15	0.000	5.88E-14	0.00	1.419	No
256	512	362	9.21E-01	0.075	1.8E-13	2.27E-16	0.000	6.01E-15	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mtum/velocit Qi/Vi	% of Bed From Particles in Motion	cumulativ % in Bed	Approx D50
0.2	53	13	Suspended	Suspended	66	0	Suspended	Suspended	Suspende	0%	
0.4	53	13	98	158	66	0	66.116	8.53E-04	5%	5%	
0.7	53	13	94	143	66	0	66.116	9.00E-04	5%	10%	
1.4	53	13	84	129	66	0	66.116	9.97E-04	6%	16%	
2.8	41	10	68	105	51	0	50.850	9.48E-04	5%	21%	
5.7	65	16	43	67	67	15	66.537	1.95E-03	11%	33%	
11.3	24	6	15	23	23	8	22.854	1.95E-03	11%	44%	18
22.6	1	5	0	0	0	5	0.336	1.95E-03	11%	55%	
45.3	0	5	0	0	0	5	0.000	1.95E-03	11%	66%	
90.5	0	2	0	0	0	2	0.000	1.95E-03	11%	78%	
181.0	0	2	0	0	0	2	0.000	1.95E-03	11%	89%	
362.0	0	2	0	0	0	2	0.000	1.95E-03	11%	100%	
			Total 404			Total 38.9	% Cap Used: 39%	Sum = 1.7E-02			

D50 11 mm

Appendix C: Response to Public Comments Received on the Draft Middle Fork Payette River Sub-basin Assessment and TMDL

The Draft Middle Fork Payette Sub-basin Assessment and TMDL (Draft TMDL) was made available for a 45 day public comment period which extended from September 30, 1998 through November 18, 1998. Copies of the Draft TMDL were presented to the South West Basin Advisory Group and cooperating agencies and stakeholders at their October 1st, 1998 meeting. Notices containing a draft document description, locations of available copies, directions for written comment submittal, IDEQ agency contacts, and a notification of a public meeting to be held in Crouch, Idaho were posted twice in the Idaho Statesman and the Idaho World. A public meeting was held at the Garden Valley Senior Center, Garden Valley, Idaho on October 28, 1998 to present the main findings of the draft document and to answer questions from the community.

A total of nine written comments were received from interested agencies and stakeholders, including one comment signed by 23 individuals living and working within the Middle Fork Payette Sub-basin. All comments received were reviewed and discussed both internally and with the commenting party when possible. Comments were received from the following agencies, organizations, companies, and individuals:

Environmental Protection Agency
USDA Forest Service, Boise National Forest
Idaho Department of Lands
Idaho Department of Fish and Game
Idaho Conservation League/Idaho Rivers United
Intermountain Forest Industry Association
Boise Cascade Corporation
Garden Valley Residents
Herb Malany, South West Basin Advisory Group

The following is a list of comments received during the 45 day public comment period by the IDEQ. Please note that the comment listed may not be verbatim. Each comment is followed by a response which includes whether the comment was incorporated into the final Middle Fork Payette Sub-basin Assessment and TMDL (final TMDL).

Tim Hamlin, US Environmental Protection Agency, Region 10

1. The target loads must be linked to water quality standards along with a demonstration on how these target loads will fully support beneficial uses.

The IDEQ acknowledges that an understanding of the linkages between narrative water quality standards and beneficial use support is required before beneficial use support can be achieved. However, limited or inappropriate data, coupled with time constraints, allowed only partial linkages to be developed for inclusion within the final TMDL. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate linkages, an additional section is included which outlines on going efforts to determine current conditions and improved linkages within the sub-basin.

2. Establish measurable targets so that responsible agencies and/or landowners will be able to decide where, how and by how much to reduce sediment.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy. The Watershed Advisory Group, along with designated responsible management agencies, is the designated entity required to develop the Implementation Plan and to ensure target attainment (i.e., beneficial use support).

3. If there are areas where increasing the sediment load to the target percent above background would degrade existing quality, the State of Idaho Antidegredation Policy would need to be met.

Changes have been made in the final TMDL document to specify that land use activities within the Middle Fork Payette Sub-basin will continue to be conducted so that they comply with the State of Idaho Antidegredation Policy as stated in IDAPA 16.01.02.051.

4. The TMDL lacks an identifiable load allocation.

TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocation (WLA) for point sources and Load Allocation (LA) for nonpoint sources, including a margin of safety (MOS) and natural background conditions. The final TMDL submitted to the EPA by the IDEQ established Load Allocations (i.e., for nonpoint sources), a margin of safety, and natural background conditions for each of the impaired reaches in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed.

5. The TMDL needs to consider all available data, such as the bacteria data collected in 1997, to make status calls using the Water Body Assessment Guidance.

The IDEQ evaluated the support status for all beneficial uses within the Middle Fork Payette Sub-basin by using the most complete data available at the time of document development. All water body assessments were made using available data received as a result of requests submitted to multiple agencies (e.g., USDA Boise National Forest, Boise Cascade Corp., IFG, IDWR, BOR, and USGS) on July 11, 1997 and are available in the IDEQ document support files. One bacteria samples was taken on September 11, 1997 that showed 560/100 ml colonies of fecal coliform. This level exceeds the primary contact recreation criteria for no more than 500/100 ml colonies of fecal coliform at any time. Since duration and frequency of the criteria exceedence is unknown, and the sample collected was found to be within 12% of the criteria, it was determined that this exceedence was minor and therefore does not downgrade the beneficial use.

6. The IDEQ must assess use support prior to removal from the 303(d) list, e.g., salmonid spawning in Scriver and Anderson Creeks.

The reason for the "Not Assessed" support status call for salmonid spawning on Scriver and Anderson Creeks is available in the IDEQ document support files. These two water bodies have a revised assessment of "Full Support" in the final TMDL document.

7. Present data to backup the full support of salmonid spawning status call in the lower Middle Fork Payette River.

These data are not available for those sections of the Middle Fork Payette River, and thus forces the IDEQ to make this assessment based on best professional judgement. The Data Gaps section within the final TMDL discusses these issues in more detail.

8. Please explain or clarify how the TMDL accounts for seasonal variation and critical conditions.

The Clean Water Act Section 303(d) specifies that, for those waters identified as water quality limited, a TMDL must be established "at a level necessary to implement the applicable water quality standards **with seasonal variations** and a margin of safety which takes into account any lack of knowledge concerning that relationship between...*these*...limitations and water quality" (emphasis added). The final TMDL proposed by the IDEQ meets these requirements by establishing sediment targets in terms of a "percent above background" based on the **bankfull discharge** from the Middle Fork Payette River resolved into an estimated **annual background and current annual sediment load**. This means that the allocations established by this TMDL are in terms of a percent above background of the **annual sediment load**. Flexibility to quantify the load capacity and allocations in annual verses daily sediment loads is provided in 40 CFR Part 130.2(i). Note that the Middle Fork Payette River is an unregulated system, flows occur according to seasonal patterns and annual variations. Therefore, the annual allocations established reflect the Middle Fork Payette seasonal patterns and annual variations due to the flexibility inherent in evaluating the sediment yield in terms of a "percent above background".

9. Include the basis for stream listings on the 303(d)list early in the sub-basin assessment.

Changes have been made in the final TMDL document to address this comment.

10. What was the basis for subwatershed ranking? How do these rankings fit into the sediment source assessment?

Changes have been made in the final TMDL document to address this comment.

11. Include a table which identifies both hill slope delivery and surface erosion delivery rates.

Changes have been made in the final TMDL document to address this comment.

12. Where is streambank erosion active and what percentage of the sediment load is from bank erosion?

Changes have been made in the final TMDL document to address this comment.

13. Clarify monitoring by landowners, what and how do they interpret data?

Changes have been made in the final TMDL document to address this comment.

14. The TMDL should establish a framework which specifically outlines the elements that need to be evaluated by land managers. These might include: surface and fluvial erosion and mass

failure risk from proposed and existing impacts.

Changes have been made in the final TMDL document to address this comment.

15. The TMDL should estimate the existing and potential sources of sediment in the watershed to conceptualize the present condition of the river and establish the load reduction needed.

The IDEQ acknowledges that an understanding of the linkages between sediment sources and the present condition of the Middle Fork Payette River is required to identify specific actions for TMDL target attainment. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate linkages, an additional section is included which outlines on going efforts to determine current conditions and an improved understanding of the linkages within the sub-basin.

16. The TMDL needs to list all limitations and assumptions used in the loading analysis.

Changes have been made in the final TMDL document to address this comment.

17. The TMDL needs to fully explain the modeling analysis and assumptions and qualify and quantify the effects theses assumptions have on the certainty of output.

Changes have been made in the final TMDL document to address this comment.

18. Please explain why the Parker model was used for a sand bed streams.

Changes have been made in the final TMDL document to address this comment.

19. Please explain why a 10% margin of safety is adequate.

Changes have been made in the final TMDL document to address this comment.

20. Update surface erosion estimates from SedMod to represent current conditions.

In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides an inadequate current condition assessment, an additional section is included which outlines on going efforts to determine current conditions within the Middle Fork Payette River sub-basin.

David Rittenhouse, USDA Forest Service, Boise National Forest

1. An appropriate description of "excess sediment" and "majority of roads in poor shape" is needed.

Changes have been made in the final TMDL document to address this comment.

2. The proposed feedback loop needs to be improved. Pool or riffle monitoring is recommended.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy.

3. The TMDL needs an identifiable endpoint for the implementation of BMPs and the desired

future condition.

In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy. This section includes how Watershed Advisory Group members, along with designated responsible management agencies, are to ensure target attainment (i.e., beneficial use support). These may include, but might not be limited to, identifiable endpoints and the desired future condition for the impaired reaches within the sub-basin.

4. The TMDL needs to allow short term increases in sediment for the purpose of achieving long term sediment reduction goals.

Changes have been made in the final TMDL document to address this comment.

5. Lower elevation private land should also be held accountable for sediment reductions.

Changes have been made in the final TMDL document to address this comment.

6. The IDEQ should be responsible for operation of the feedback loop and related monitoring.

The IDEQ expects to continue to be involved as the Middle Fork Payette TMDL is implemented as one of the designated responsible agencies as specified in Idaho Code Title 39, Chapter 36 and IDAPA 16.01.02. Additionally, the TMDL submitted to the EPA by the IDEQ contains an added section which outlines a suggested implementation plan development strategy. Specific feedback loops to show instream progress towards beneficial use support may be included in the Middle Fork Payette Implementation Plan.

Bill Love, Idaho Department of Lands

1. Modeling efforts do not reflect current conditions in the watershed.

The IDEQ acknowledges that an understanding of the current conditions is required before specific actions for TMDL target attainment can be identified. However, limited or inappropriate data, coupled with time constraints, allowed only a partial understanding of current conditions to be included within the final TMDL. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides an inadequate current conditions assessment, an additional section is included which outlines on going efforts to determine current conditions within the sub-basin.

2. The TMDL does not provide a means of testing whether or not sediment targets are attained.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy.

3. Amend TMDL to specify CWE as the tool to identify forested landscape problems. The CWE process should also be used to design management practices to correct problems and improve water quality.

Changes have been made in the final TMDL document to address this comment.

4. The TMDL should use the IDEQ beneficial use support status as the target.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. Attainment of these targets and/or full support of beneficial uses will indicate that the TMDL has been adequately implemented.

5. The IDL does not support the requirement that land managers and land owners be responsible for evaluating sediment production rates in terms of "percent above background".

The Clean Water Act Section 303(d) and 40 CFR Part 130.2 defines the pollutant load capacity for a water quality limited water body as the maximum amount of pollution allowed at a designated time and place. This suggests that technical assessment and load allocations that make up the load capacity must be presented in terms of a "mass/time", or some other method of measurement, to ensure that the load capacity is not exceeded. The final TMDL proposed by the IDEQ meets these requirements by establishing sediment targets within the Middle Fork Payette Sub-basin Assessment and TMDL in terms of a "percent above background" based on the **bankfull discharge** from the Middle Fork Payette River resolved into an estimated **annual background and current annual sediment load.** This means that the allocations established by this TMDL are in terms of a percent above background of the **annual sediment load.**

6. Reasonable assurance of nonpoint source reductions from this TMDL is not possible because 1) the sources have not been adequately identified, 2) description of the actual amounts of the sediment pollutant is lacking, and 3) no way is identified to measure whether the pollutant is being reduced.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy.

7. Sediment targets for Pyle and Scriver Creek sub-watersheds are not reasonable.

The final Middle Fork Payette Sub-basin Assessment and TMDL submitted to the EPA by the IDEQ specifies load capacities, target nonpoint management load allocations, margin of safety, and background loads for each of the contributing areas to the impacted reaches only. This reflects a change between the draft TMDL and the final TMDL submitted. By providing targets in terms of a "percent above background" cumulatively for each of the impaired reaches only, the sediment targets for Pyle and Scriver Creek sub-watersheds are to be examined in combination with other areas and tributaries which contribute sediment to the impaired reaches. Because these allocations are for the entire contributing area of each of the impaired reaches, the IDEQ expects the issue of sediment management for each land use within each contributing area to be resolved in a cooperative manner during the implementation phase of the final Middle Fork Payette Sub-basin Assessment and TMDL.

8. It is unreasonable to expect land management agencies to adjust their activities for annual weather patterns.

The Clean Water Act Section 303(d) specifies that, for those waters identified as water quality limited, a

TMDL must be established "at a level necessary to implement the applicable water quality standards **with seasonal variations** and a margin of safety which takes into account any lack of knowledge concerning that relationship between...*these*...limitations and water quality" (emphasis added). The final TMDL proposed by the IDEQ meets these requirements by establishing sediment targets in terms of a "percent above background" based on the **bankfull discharge** from the Middle Fork Payette River resolved into an estimated **annual background and current annual sediment load**. This means that the allocations established by this TMDL are in terms of a percent above background of the **annual sediment load**. Flexibility to quantify the load capacity and allocations in annual verses daily sediment loads is provided in 40 CFR Part 130.2(i). Note that the Middle Fork Payette River is an unregulated system, flows occur according to seasonal patterns and annual variations. Therefore, the annual allocations established reflect the Middle Fork Payette seasonal patterns and annual variations due to the flexibility inherent in evaluating the sediment yield in terms of a "percent above background".

9. Additional specific comments on the draft Problem Assessment and TMDL for the Middle Fork Payette.

Changes have been made in the final TMDL document to address these comments.

Scot Grunder, Idaho Department of Fish and Game

1. Empirical evidence to support the statement that the current sediment load within the basin is a result of recent landslide activity needs to be included.

Changes have been made in the final TMDL document to address this comment.

2. The TMDL needs to clearly separate out hatchery stocks of rainbow trout from indigenous rainbow trout.

Changes have been made in the final TMDL document to address this comment.

3. The TMDL needs to state how habitat improvements will be documented if there are no plans to measure sediment load changes in specific stream habitat features (e.g., pools, spawning gravels, etc.).

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. Attainment of these targets and/or full support of beneficial uses will indicate that the TMDL has been adequately implemented. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy.

4. The sources of sediment must be managed and arrested first, artificial habitat structures should only occur as a last resort.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. An additional section in the final TMDL includes how Watershed Advisory Group members, along with designated responsible management agencies, are to ensure target attainment (i.e., beneficial use support). The IDEQ expects the issue of sediment management and beneficial use attainment to be resolved in a cooperative manner during the implementation phase of the final Middle Fork Payette Sub-basin Assessment and TMDL.

5. Point out in Appendix A that, while there are factors affecting fish populations other than habitat (e.g., exotic fish species, loss of anadromous fish, and hatchery stockings), the native fish species can more than hold their own against exotic brook trout if habitat is intact.

Changes have been made in the final TMDL document to address this comment.

Scott Brown, Idaho Conservation League; Marti Bridges, Idaho Rivers United

1. TMDL fails to establish any benchmarks by which to mark progress toward fully supporting beneficial uses.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy.

2. Adoption of stream morphology goals is the proper approach to addressing uncertainty with sediment loading.

The Clean Water Act Section 303(d) specifies that, for those waters identified as water quality limited, a TMDL must be established "at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning that relationship between...*these*...limitations and water quality". The final TMDL proposed by the IDEQ meets these requirements by establishing sediment targets in terms of a "percent above background" based on the **bankfull discharge** from the Middle Fork Payette River resolved into an estimated **annual background and current annual sediment load**. This means that the allocations established by this TMDL are in terms of a percent above background of the **annual sediment load**. Flexibility to quantify the load capacity and allocations in annual verses daily sediment loads is provided in 40 CFR Part 130.2(i). The final TMDL includes an added section which outlines an implementation plan development strategy. This section includes how Watershed Advisory Group members, along with designated responsible management agencies, are to ensure target attainment (i.e., beneficial use support). Target attainment may include specific feedback loops and/or river morphology goals to show instream progress towards beneficial use support.

3. TMDL does not establish a link between up slope management goals and downstream beneficial use impairment.

In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate linkages, an additional section is included which outlines on going efforts to determine current conditions and improved linkages within the sub-basin.

4. A feedback mechanism involving number of pools per mile in the lower reach of the river is needed to determine progress towards beneficial use support.

The final TMDL includes an added section which outlines an implementation plan development strategy.

This section includes how Watershed Advisory Group members, along with designated responsible management agencies, are to ensure target attainment (i.e., beneficial use support). Target attainment may include specific feedback loops and/or river morphology goals to show instream progress towards beneficial use support.

5. River morphology must be considered to improve sediment impairment of the river.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy. The Watershed Advisory Group, along with designated responsible management agencies, is the designated entity required develop the Implementation Plan and to ensure target attainment (i.e., beneficial use support).

6. Clearly define, explain, and seek to fill data gaps.

An additional section added to the final TMDL document outlines a suggested implementation plan development strategy. This section also includes on going efforts to provide an improved understanding of current conditions, fill data gaps, and provide information required for Implementation Plan development.

7. Utilization of BURP monitoring on a very few stations is a weakness.

The IDEQ utilized a total of fifteen BURP monitoring stations within the Middle Fork Payette Sub-basin. This number of BURP stations is consistent with the number of stations per sub-basin state wide.

8. The IDEQ must adopt a cooperative, but specific and time certain, schedule with other agencies to generate the needed data and divide the work.

The IDEQ expects to continue to be involved as the Middle Fork Payette TMDL is implemented as one of the designated responsible agencies as specified in Idaho Code Title 39, Chapter 36 and IDAPA 16.01.02. Additionally, the TMDL submitted to the EPA by the IDEQ contains an added section which outlines an implementation plan development strategy. Specific activities associated with implementing the final TMDL and attaining beneficial use support are expected to be included in the Middle Fork Payette Implementation Plan. The Watershed Advisory Group, along with designated responsible management agencies, is the designated entity required develop the Implementation Plan and to ensure target attainment (i.e., beneficial use support).

9. Water Body Assessments in the TMDL should not have ignored habitat indices for BURP monitoring.

The IDEQ evaluated the support status for all beneficial uses within the Middle Fork Payette Sub-basin by using the most complete data available at the time of document development. Habitat indices were not ignored, but were placed lower in the decision tree (i.e., other data sets were looked before habitat). However, habitat indices are used to determine salmonid spawning use support.

10. No assessment of salmonid spawning for several Middle Fork Payette River tributaries.

The IDEQ evaluated the support status for all beneficial uses within the Middle Fork Payette Sub-basin by using the most complete data available at the time of document development. The final TMDL reflects additional support status analysis that was unable to be completed in time for the draft TMDL document. Salmonid spawning was assessed for each of the 1996 303(d) listed tributaries.

11. TMDL should apply to all currently listed 303(d) segments and should address both existing and designated beneficial uses.

The final TMDL addresses all segments that are both on the 1996 303(d) list and found to be water quality limited. Segments that have allocations established by the final TMDL document are those reaches located in the lower portion of the Middle Fork Payette River below Big Bulldog Creek. The tributaries to these lower reaches have been determined to not be water quality limited (i.e., impaired) due to sediment because they rapidly transport elevated sediment loads, without showing much change to either the macro-invertebrate populations, fish populations, or channel morphology. Therefore, these tributaries have been determined to be sources of sediment, but not water quality limited due to sediment.

12. Streams identified as being cleaner than that required by the water quality standards must not be degraded below their current condition.

Changes have been made in the final TMDL document to specify that land use activities within the Middle Fork Payette Sub-basin will continue to be conducted so that they comply with the State of Idaho Antidegredation Policy as stated in IDAPA 16.01.02.051.

13. It is unacceptable to trade sediment delivery between watersheds to allow a sub-basin load goal to be met.

The final TMDL submitted to the EPA by the IDEQ establishes pollutant load capacities, nonpoint management load allocations, margin of safety, and background loads for the contributing areas for each of the impaired reaches of the Middle Fork Payette River. The final TMDL submitted specifies that land use activities within the Middle Fork Payette Sub-basin will continue to be conducted so that they comply with the State of Idaho Antidegredation Policy as stated in IDAPA 16.01.02.051.

14. Inadequate objectives are proposed within the TMDL to attain bull trout support.

The TMDL submitted to the EPA by the IDEQ contains an added section which outlines an implementation plan development strategy. Specific feedback loops to show instream progress towards beneficial use support are expected to be included in the Middle Fork Payette Implementation Plan. The IDEQ expects these issues to be further resolved during the implementation phase of the final TMDL and during the development of the Bull Trout Recovery Plan through the South West Basin Native Fish Watershed Advisory Group.

15. Stream and habitat objectives must be met before deletion from the 303(d) list.

The IDEQ evaluated the support status for all beneficial uses within the Middle Fork Payette Sub-basin by using the most complete data available at the time of document development. Habitat indices were not ignored, but were placed lower in the decision tree (i.e., other data sets were looked before habitat).

16. Establish measurable substrate goals.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final

TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy. The Watershed Advisory Group, along with designated responsible management agencies, is the designated entity required develop the Implementation Plan and to ensure target attainment (i.e., beneficial use support).

17. TMDL must address temperature problems which may limit bull trout recovery.

None of the data currently available show exceedences of the Idaho water quality criteria for temperature.

Dave Mabe, Intermountain Forest Industry Association

1. Sediment allocation should be clarified to state that all sources of nonpoint pollution are required to reduce to a percent over background.

Changes have been made in the final TMDL document to address this comment.

2. Improve landslide estimates in the TMDL.

The IDEQ acknowledges that an understanding of the current conditions (including landslide activities) is required before specific actions for TMDL target attainment can be identified. However, limited or inappropriate data, coupled with time constraints, allowed only a partial understanding of current conditions to be included within the final TMDL. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides an inadequate current conditions assessment, an additional section is included which outlines on going efforts to determine current conditions within the sub-basin.

3. Mention that CWE and/or SedMod will be used to identify landscape treatments needed, improve sediment load estimates and address background sediment issues in the implementation phase.

Changes have been made in the final TMDL document to address this comment.

4. A more defined discussion of the next step in the creation of an implementation plan is needed.

An additional section added to the final TMDL document outlines an implementation plan development strategy. This section includes how Watershed Advisory Group members, along with designated responsible management agencies, will clarify how monitoring, data analysis, and subsequent document revisions will be conducted.

Domoni Glass, Boise Cascade Corporation

1. The TMDL must link land use and the pollutant of concern.

The IDEQ acknowledges that an understanding of the linkages between narrative water quality standards and beneficial use support is required before beneficial use support can be achieved. However, limited or inappropriate data, coupled with time constraints, allowed only partial linkages to be developed for inclusion within the final TMDL. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate linkages, an additional section is included which outlines on going efforts to determine current conditions and improved linkages within the sub-basin.

2. A sediment budget needs to be developed for the Middle Fork Payette Sub-basin which

includes non forestry land uses.

The final Middle Fork Payette Sub-basin Assessment and TMDL establish load capacities, target nonpoint management load allocations, margin of safety, and background loads for each of the contributing areas to the impacted reaches, and are not specified for forestry land uses only (i.e., the entire contributing area is considered in these allocations, regardless of the type of land use present). The IDEQ acknowledges that better information on current conditions are required before specific actions for target attainment can be developed. The final TMDL submitted to the EPA by the IDEQ contains an added section which outlines on going efforts to determine current conditions in the watershed and provides an implementation plan development strategy. The Watershed Advisory Group, along with designated responsible management agencies, is the designated entity required develop the Implementation Plan and to ensure target attainment (i.e., beneficial use support).

3. The IDEQ must commit to assisting land owners develop sediment budget in the implementation plan.

The IDEQ expects to continue to be involved as the Middle Fork Payette TMDL is implemented as one of the designated responsible agencies as specified in Idaho Code Title 39, Chapter 36 and IDAPA 16.01.02. Additionally, the TMDL submitted to the EPA by the IDEQ contains an added section which outlines on going efforts to determine current conditions in the watershed.

4. The IDEQ must be involved in addressing unregulated land uses.

The IDEQ expects to continue to be involved as the Middle Fork Payette TMDL is implemented as one of the designated responsible agencies as specified in Idaho Code Title 39, Chapter 36 and IDAPA 16.01.02.

5. The current conditions described in Appendix B should be brought into the text.

Changes have been made in the final TMDL document to address this comment.

6. The TMDL should provide a vehicle for de-listing improperly listed streams and should be used as such.

Changes have been made in the final TMDL document to address this comment.

7. It is inappropriate to set targets for unlisted tributary streams.

Changes have been made in the final TMDL document to address this comment.

8. The TMDL needs to cite on going efforts that will be used to address sediment concerns in the basin.

Changes have been made in the final TMDL document to address this comment.

9. The TMDL needs language which clearly states that the targets are subject to change and that the management practices adopted may also change in response to new information.

Changes have been made in the final TMDL document to address this comment.

10. The TMDL should provide enough information to support de-listing, if appropriate, hence the logic that removed segments from the list.

Changes have been made in the final TMDL document to address this comment.

11. The geology map within the TMDL needs to be improved.

Changes have been made in the final TMDL document to address this comment.

12. The TMDL document needs a sub-basin map with township and range lines, Crouch and stream names.

Changes have been made in the final TMDL document to address this comment.

13. The TMDL needs to further explain the steps taken to arrive at the loads and reductions.

Changes have been made in the final TMDL document to address this comment.

14. Additional information on background and management related landslides needs to be provided.

Changes have been made in the final TMDL document to address this comment.

15. The effect of data collected after a 50 year event has on the modeling conducted needs to be described.

Changes have been made in the final TMDL document to address this comment.

16. A margin of safety is not needed.

The Clean Water Act, Section 303(d) specifies that, for those waters identified as water quality limited, a TMDL must be established "at a level necessary to implement the applicable water quality standards with seasonal variations and **a margin of safety** which takes into account any lack of knowledge concerning that relationship between...*these*...limitations and water quality" (emphasis added). The IDEQ attempts to meet these requirements by establishing sediment targets within the final TMDL in terms of a "percent above background" amount for all flows within the Middle Fork Payette River with a margin of safety. The IDEQ expects these targets will be adjusted over time as progress to beneficial use support is attained. The iterations required in this approach suggest that a conservative approach in establishing the initial sediment targets is needed. The IDEQ asserts that if these targets are attained, the support of the beneficial uses will improve.

17. Additional specific comments provided on the Draft Middle Fork Payette Sub-basin Assessment and TMDL.

Changes have been made in the final TMDL document to address this comment.

Garden Valley Residents

1. Costs to attain beneficial use support must be reasonable.

The Middle Fork Payette TMDL establishes sediment targets for land managers in terms of a "percent above background" amount for each of the impaired reaches. Attainment of these targets and/or full support of beneficial uses will indicate that the TMDL has been adequately implemented. The IDEQ expects that Watershed Advisory Group members, along with designated responsible management agencies, shall ensure sediment target attainment and/or beneficial use support within the impaired reaches of the Middle Fork

Payette River, and may conduct a cost analysis for target attainment.

2. An acceptable assurance of success is needed within the TMDL document.

The IDEQ acknowledges that better information on the linkages between land uses and narrative water quality standards and beneficial use support is required before beneficial use support and/or TMDL targets can be achieved. However, limited or inappropriate data and time constraints did not allow improved linkages to be developed for inclusion within the final TMDL. In order to address this concern, the TMDL submitted to the EPA by the IDEQ contains an added section which outlines on going efforts to determine current conditions within the Middle Fork Payette River Sub-basin.

3. Other resource interests (e.g., recreation) must also be protected.

The Middle Fork Payette TMDL establishes sediment targets for land managers in terms of a "percent above background" amount. Attainment of these targets and/or full support of beneficial uses will indicate that the TMDL has been adequately implemented. The IDEQ expects that Watershed Advisory Group members, along with designated responsible management agencies, shall ensure sediment target attainment and/or beneficial use support within the impaired reaches of the Middle Fork Payette River in such as way as to accommodate other resource interests within the sub-basin.

4. Acceptable levels of sediment should not be based on arbitrary percent above background numbers.

The IDEQ acknowledges that an understanding of the linkages between narrative water quality standards and beneficial use support is required before beneficial use support can be achieved. However, limited or inappropriate data, coupled with time constraints, allowed only partial linkages to be developed for inclusion within the final TMDL. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate linkages, an additional section is included which outlines on going efforts to determine current conditions and improved linkages within the sub-basin.

Herb Malany, South West Basin Advisory Group

1. Develop a guidance pamphlet referencing existing laws, rules, procedures, protocols for the implementation phase.

An additional section added to the final TMDL document outlines an implementation plan development strategy. This section includes how Watershed Advisory Group members, along with designated responsible management agencies, will clarify how monitoring, data analysis, and subsequent document revisions will be conducted.

2. Need feedback guidance to establish acceptable goals.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed. Attainment of these targets and/or full support of beneficial uses will indicate that the TMDL has been adequately implemented. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy.

3. Use English units of measure.

Changes have been made in the final TMDL document to address this comment.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
IDAHO OPERATIONS OFFICE
1435 N. Orchard St.
Boise, Idaho 83706

RECEIVED
APR 12 1999
DIVISION OF
ENVIRONMENTAL QUALITY
BOISE REGIONAL OFFICE

April 12, 1999

Michael McIntyre
Idaho Division of Environmental Quality
1410 North Hilton
Boise, Idaho 83706

Dear Mike,

We have completed our review of the Final Middle Fork Payette River Sediment TMDL, and per our conversation, I wanted to provide you our comments. In our review we found three aspects of the TMDL were deficient: the supporting rationale for the target; the application of the bedload model; and technical errors in the analysis. In addition, we do not agree that there is a sufficient basis to justify not writing TMDLs for Scriver and Anderson Creeks. These issues are explained in more detail below. Hopefully this will clarify our position, and provide a basis for further discussion.

Water Quality Target:

The TMDL recognizes that factors limiting beneficial use support include the lack of pools and excess fine gravel and coarse sand material (i.e, < 8 mm). A bed material deposition rate of 50% above background is used as an interim target to set the load allocations and margin of safety. No other surrogate measures are proposed (e.g., pool frequency or surface fines). As support for this target, the document cites the USDA Forest Service (USFS), Boise National Forest criteria which allows a 100% percent increase in sediment load to a critical reach. The remaining support includes a statement that the USFS believes 50% is conservative based upon unspecified observations, and a statement that ongoing IDEQ BURP analysis will provide a feedback loop to management.

TMDLs are required to be established at levels which meet water quality standards, including full support of beneficial uses, and achieving all applicable water quality standards. Our concerns with this target are as follows.

- As indicated in our previous comments on the draft TMDL, the TMDL does not clearly link the cause of impairment to the instream target, load reductions and beneficial use support;
- There does not appear to be any rationale as to why an increase in bed deposition rate of 50% above background would result in full support of beneficial uses;
- The USFS criteria cited as support for the TMDL target is a target for sediment yield, which is much different than a bed deposition rate, and the USFS target itself is not linked to full support of beneficial uses - it is simply a management target set below

levels clearly documented to be excessive; and

- The bed deposition rate is not measurable, therefore there is no way to measure whether the target has been achieved or whether progress is being made.

Ensuring that the target (and hence the allocations) will achieve water quality standards is likely the most critical element of a TMDL. Discussion on this point within the Middle Fork Payette TMDL is conflicting. For example, on page 41 the TMDL states "whether these improvements [50% above background] are great enough to meet beneficial use support, either on their own or through additional measures, is **unknown at this time**", whereas on page 44 the TMDL states "This TMDL establishes a sediment production threshold for the impaired reaches (R5, R6, and R7) that **will achieve** the Idaho water quality criteria for sediment and beneficial use support". Finally on page 46 the TMDL states "The IDEQ asserts that if these sediment targets are attained the support of the beneficial use **will improve**".

Considering that the linkage between the cause of impairment, load reductions and beneficial use support status has not been established, and since rationale to support that a 50% above background deposition rate will fully support beneficial uses is lacking, we have concluded that the TMDL does not provide assurance that the goals of the CWA and implementing regulations [40CFR130.7(c)(1)] would be met.

Model Mis-application:

The TMDL analysis used the Parker (1982) bedload transport equation on the impaired reaches of the Middle Fork Payette River (i.e., R-5, 6, and 7). The Parker (1982) equation, developed from a gravel-bed stream (Parker and Klingeman, 1982), is intended for use in coarse gravel bed streams (Yang, 1996). The lower reaches of the MF Payette River are presently sand-bed reaches with distinct bedforms (i.e., d50 = 1.75 mm; dunes and upper regime plane-beds). Two critical assumptions of the Parker (1982) equation were violated in the TMDL loading analysis:

1) the TMDL analysis assumes that the bedload and pavement have the same particle size distributions, whereas field data show they are substantially different; and
2) the TMDL analysis assumes that no bedforms are present, whereas field data show they are present (dunes and upper regime plane-beds).

The Parker (1982) equation uses bed stress to estimate sediment transport potential. Parker and Klingeman (1982) pg. 1419 show how in sandbed streams the effective grain stress should be used rather than bed stress. Additionally, Wilcock (1998) demonstrates that the critical shear stress varies significantly between gravel and sand-bed streams. Yang (1996) states that Parker (1982) is appropriate for coarse gravel-bed streams and that the Yang and/or Ackers and White equations should be used for fine gravel and sand-bed streams.

Recent data collected as part of EPA/USFS/IDEQ monitoring (available prior to TMDL development) also support the above conclusion and demonstrates how the assumptions of Parker (1982) are violated. EPA data analysis and preliminary sediment transport modeling demonstrate that the Parker (1982 and 1990) equations grossly over-predict (1000-3000%) sediment transport potential in the lower reaches (Fitzgerald and Borden, 1999), which may greatly underestimate the magnitude of the sediment deposition rate.

Beneficial Use Support Status:

Prior to TMDL development the IDEQ assessed the status of the listed waterbodies within the Middle Fork Payette River Subbasin. Readily available information was used to make the support status calls, resulting in an adequate evaluation of coldwater biota use support status, notwithstanding EPA concerns with the WBAG process. However, EPA provided written comments on the draft TMDL on November 18, 1998 regarding support status calls for salmonid spawning uses in the mainstem, Scriver, and Anderson Creeks, indicating that it was inappropriate for IDEQ to determine that these uses are "full support" without having and using supporting data. This approach was not changed in the final TMDL, and "full support" salmonid spawning status calls were used to remove these segments from the 303(d) list and to support not developing TMDLs for Scriver and Anderson Creeks. We could not approve such a basis for removing waters from the 303(d) list, and in our view, TMDLs for these segments are still expected pursuant to the Idaho TMDL schedule.

Technical and Documentation Issues:

The following narrative briefly documents EPA's technical review of the TMDL. In summary, EPA found the analysis very difficult to track due to the lack of adequate explanation and literature citation of the analysis steps and results, and critical mistakes which appeared in the final document (e.g., wrong spreadsheets in the Appendix B). Based on the scientific literature and the measured characteristics of the impaired stream, EPA concludes that the Parker (1982) bedload transport equation was mis-applied. Finally, the response to comments failed to adequately address EPA's technical comments 16-20, and other comments submitted outside of EPA regarding the technical validity of the analysis (e.g., is the sediment stored in the lower mainstem episodic or chronic, Idaho Fish and Game), which primarily address issues discussed below.

Documentation

The TMDL analysis uses methods well established in the scientific literature, however, this particular application requires substantial documentation and literature citation due to the complexity and uncertainty associated with the analysis. Because much of the documentation was lacking, it was necessary for EPA to spend considerable time reconstructing the analysis.

The following summarizes EPA's understanding of the analysis, to the best of our knowledge. First, the load capacity is defined in terms of a bed-material load deposition rate. The analysis assumes that water quality standards and beneficial uses will be maintained/met at a deposition rate of 50% above background, and instream targets, load capacities, allocations, and MOS are set using this assumption.

The sediment transport analysis uses sediment erosion models and bed-material transport equations. We constructed Figure 1 to illustrate our understanding of the general steps and process involved in the target and loading analyses. The TMDL analysis uses established field procedures and methods to collect data, a verified erosion model (i.e., BOISED) to define background input, and a verified bedload transport equation (Parker (1982)) to estimate the bedload deposition rate. Background hillslope erosion and delivery, and stream sediment yield are modeled using the USDA Forest Service model BOISED and a potential sediment delivery coefficient, respectively. Channel geometry, grain size distribution, and stream flow were measured in the field at seven sites. These data were input to the Parker (1982) bedload transport equation and used to estimate the sediment transport potential.

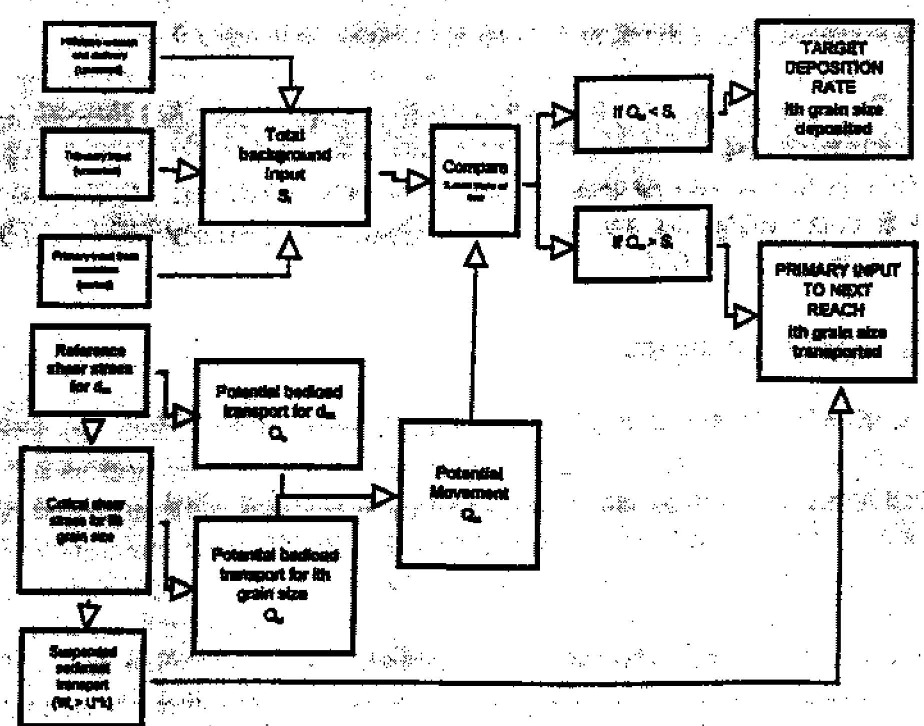

Figure 1. Sediment analysis framework.

Undocumented assumptions

The basic logic of this analysis appears sound, however, there is great uncertainty associated with the results which facilitates the need to rigorously document all of the assumptions. EPA determined that the following assumptions were made but were not documented in the final TMDL:

1) the bankfull discharge is the effective discharge initiating significant bed material transport and is responsible for the long-term average bed material load and configuration of the streambed;

2) the bankfull discharge has remained constant since human disturbance of the watershed;
3) bankfull discharge only occurs once a year;
4) if the bankfull discharge does not move a particle of a given size fraction, then that particle remains deposited;
5) bedload transport occurs only at bankfull discharge;
6) given the three sediment inputs (Figure 1), no winnowing of fine sediment occurs on the hillslope, no selective transport occurs in the tributaries, and no particle abrasion occurs between reaches;
7) Parker (1982) assumes the bed material load and the pavement have similar particle size distribution;
8) smooth boundary conditions in the channel (Stoke's Law used for settling velocity); and
9) all the assumptions associated with Shield's critical shear stress apply.

Technical errors

As part of EPA's final review, we identified four critical technical errors in the overall analysis.

- Different background deposition rates are listed in the tables in the technical appendix (i.e., Table 4 (pg. B9); Tables 12e, f, & g (pgs. B24-26). After submittal of the final TMDL, it was discovered that Tables 12e, f, & g are not the correct tables.

- Second, the flow estimates from Manning's Equation appear to grossly overestimate bankfull discharge (i.e., measured = 1100 cfs; modeled 3000 cfs) which are used to estimate the normal depth, a component of the sediment transport equation. The percent difference between measured flow and predicted flow presented in Tables 12e, f, & g are actually about 100% rather than 0-12%.

- Stoke's Law was used to calculate particle settling velocity. According to Yang (1996) Stoke's Law is only valid for smooth boundary conditions. For transitional and rough boundary conditions another formula (e.g., Rubey's Equation) should be used to calculate the settling velocity.

- Fourth, the reference shear stress (τ^*) used in the analysis, which is a critical component of this type of analysis (Buffington and Montgomery, 1997), is estimated relative to existing conditions. In other words, all deposition rate targets are calculated relative to the existing condition. Methods used to calculate the deposition rate targets should be relative to the desired conditions.

I hope this has clarified our concerns with the final TMDL. Because some of the critical steps and assumptions in the TMDL are undocumented, please let us know if our summary of your analysis is not accurate.

We look forward to discussing this with you in the near future. If this raises more questions, or if there is additional detail you need, please contact me (378-5774) or Jim Fitzgerald (378-5753).

Sincerely,

Leigh Woodruff
TMDL Coordinator

cc: Steve West, IDEQ

References

Buffington, J. M. and Montgomery, D.R., 1997. A systematic analysis of eight decades of incipient motion studies, with special reference to gravel bed rivers. Water Resources Research. Vol. 33, No. 8, pages 1993-2029.

Parker, G. and Klingeman, P.C., 1982. On why gravel bed streams are paved. Water Resources Research. Vol. 18, No. 5, pages 1409-1423.

Fitzgerald, J.K. and Borden C., 1999. Characterization of stream flow and sediment load of the Middle Fork Payette River Subbasin, Idaho using synoptic sampling techniques and empirical formulas. In proceedings from: ninth annual Nonpoint Source Water Quality Monitoring Results Workshop.

Wilcock, P. R., 1998. Two-fraction model of initial sediment motion in gravel-bed rivers. Science. Vol. 280, April 17.

Yang, C.T., 1996. Sediment Transport: theory and practice. McGraw-Hill Comp, Inc. ISBN 0-07-912265-5. pg. 262.

Discussion Points between Region 10 EPA and IDEQ on the Middle Fork Payette TMDL - Submitted December, 1998

Water Quality Targets

Issue 1: The TMDL does not clearly link the cause of impairment to the instream target, load reductions and beneficial use support.

Current support status assessment in the document state that migration and habitat needs of bulltrout are lacking within the lower reaches. Sediment load reductions will improve the conditions within the lower reaches. However, these load reductions alone may not provide all of the improvements needed at this time. The linkage between the current conditions and the suggested load reductions to the ultimate full support of beneficial uses is found in the document's feedback loop. It is the IDEQ's understanding the when the impairment to beneficial uses is due to nonpoint source activities a feedback loop with iteration is allowed, if not required. The final TMDL document allows for new loads to be established using a feedback loop that incorporates "surrogate" measurement of habitat needs of bulltrout within the impaired reaches.

Issue 2: The justification provided does not provide assurance that the goals of the CWA and implementing regulations [40CFR130.7(c)(1)] would be met.

The rational used to justify a bed deposition rate of 50% above background is based, in part, on the need for an iterative process to discover what the "true" total maximum sediment load may be. Additionally, this initial target is shown, in the final TMDL document, to be roughly half of the current sediment load within the Middle Fork Payette basin.

Issue 3: The bed deposition rate is not measurable, therefore, there is no way to measure whether the target has been achieved or whether progress is being made.

The TMDL sediment targets are **hillslope sediment production rates**. Land managers are to use the **hillslope sediment production rates** for the contributing areas listed in the document as the TMDL sediment target until the feedback loop or beneficial use support indicates it should be lowered or raised.

The sediment transport model was used to show the relationship between hillslope sediment rates and inputs to a reach and the changes to the transport out (and deposition of) an estimated amount of sediment. Flow and sediment amounts selected were used to characterize the relationship between background and target - under steady state conditions. Steady state conditions do not occur in natural systems. The modeling of sediment transport in natural systems (i.e. non-steady state) is not an exact science at this time.

Issue 4: Statements made in the final TMDL document that provide assurance that the targets and allocations will achieve water quality standards appears to be conflicting.

This issue stems primarily from editing mistakes rather than any inherent ambiguity within the TMDL's approach to water quality standard attainment. For example, the statement on page 41 was included within the TMDL to show how iteration will be required in order to achieve beneficial use support, the statement on page 44 was included to show how the narrative standard achievement and TMDL allocations are based primarily on professional judgement at this time, and, finally, the statement made on page 46 (and 44) that the beneficial use support will improve under these initial sediment TMDL targets is based on preliminary estimates that the current sediment load will be reduced by half.

Model Mis-Application

Issue 1: The streambed of the lower reaches of the Middle Fork Payette River are composed of sand sized particles and dune bedforms may be present. Therefore, form drag must be considered significant and the shear stress should be partitioned. It is suggested that the Ackers and White equation should be used.

The presence of sand dune bedforms may decrease the sediment transport rate due to the increase in form roughness relative to particle roughness. One sediment transport equation that takes dune formations into account is the Ackers and White equation. This is an empirical equation based on flume studies with a D50 of 0.9 mm. There are problems, however, in applying this equation to the Middle Fork Payette River. For example, whether dune formations are present within the Middle Fork Payette River during flood flows is not able to be determined by observation. The water during these flows is too murky. Therefore, while dunes may be present, plane bed formations (which do not require partitioning) may also be present.

Another difficulty is that, because the Ackers and White equation is an empirical equation based on a D50 of 0.9 mm, this equation would tend to overestimate the effect of form drag for those situations where the D50 is greater (i.e. 1.75 mm), such as in the case of the Middle Fork Payette River. Current research being conducted by geomorphologists rely on the Parkers equation for those situations where there is any appreciable amount of gravel (personal communication by Ned Andrews, 1999). Specifically, the Parker equation is used for those systems where the D50 is between 2.5 and 28 mm, while the Ackers and White equation is used for those systems where the D50 is near 0.9 mm. Also, Parker Equation validation studies by Andrews and Nankervis (1995) showed that this was an appropriate model for streams with similar bedload (i.e. similar D50) (see sieve data attachments).

There appears to be no perfect equation for situations where the D50 is between 0.9 and 2.5 mm. Therefore, there may be no perfect equation for the lower reaches of the Middle Fork Payette River, where the D50 may be somewhere around 1.75 mm. And, while none of the laboratory flume studies conducted had different sizes for bedload and pavement, the Parker, 1982 equation has been validated extensively in natural systems (Andrews and Nankervis, 1995).

A later point brought up by the EPA states that the analysis for the TMDL must consider the desired conditions. The sand present in the lower reaches may be a huge, transient artifact of the 1997 storm and may not be there under target or background conditions. And, while we all hope that the sand bars in the lower reaches will be gone when the effects of the 1997 storm diminishes, there remains a great uncertainty as to what the conditions will be within these lower reaches when beneficial use support is achieved. This is one of the primary reasons why it is our recommendation that iterative or "phased" TMDL targets be established for the Middle Fork Payette.

And finally, we agree that the effect of particle size (and dune formation) on sediment transport is an important consideration. As one EPA comment suggested, this effect may be high as a 3000% change in sediment transport within the lower reaches. Therefore, an additional analysis was preformed to look at the effects of this on the ratio between background and target sediment rates. Results of this analysis showed that the impact of using one value of shear stress over another is not significant (see Qb/30 in the lower reach example).

Technical Documentation Issues:

Issue 1: EPA personnel found the analysis difficult to track. Incorrect spreadsheets were submitted in Appendix B of the TMDL document.

That, in the opinion of the EPA, the document's analysis was "poorly written" is more of an editorial complaint than a technical complaint. Additionally, IDEQ personnel were available to answer questions and to take edited copies of the draft TMDL by EPA reviewers up until the final document was submitted.

Also, the spreadsheets of the final document's appendix B were correct in the draft TMDL document and are available as document corrections. Again, this issue is an editorial mistake and is mis-labeled by the EPA as a technical mistake.

Issue 2: The response to comments failed to adequately address EPA's technical comments 16-20 regarding the technical validity of the analysis.

The response to EPA technical comments 16-20 were kept short in Appendix C of the final document for editorial reasons. More detailed responses, which include document excerpts, are available to the EPA and are included here.

Issue 3: A proposed a list of nine (9) assumptions which should have been cited in the final TMDL was submitted by the EPA on April 12, 1999 and should have been in the final document.

Of the nine (9) assumptions suggested by the EPA, the IDEQ agrees with the following:

(1) The bankfull discharge is responsible for the long-term average (i.e. dominant) bed material and configuration of the streambed.
(2) The estimate of bankfull discharge has a greater error associated with it than the amount of change due to management activities within the basin.
(3) This was not assumed.
(4) As shown by the sediment transport equation, if a particle does not move under bankfull discharge conditions, then that particle size remains deposited.
(5) This was not assumed.
(6) No winnowing of hillslope input sediment particle sizes occurs (justified due to landslide input as the dominant input); no selective transport occurs in tributaries (justified for those reaches not impacted by flood plain development; and, no particle abrasion occur between reaches.
(7) The bed material load and the bed pavement have similar particle size distribution.
(8) This was not assumed (see below for explanation).
(9) Shield's critical shear stress assumptions apply.

Issue 4: EPA identified four critical technical errors in the overall analysis: 1) incorrect tables were included in Appendix B of the final document, 2) the bankfull flow, as estimated by the Manning's equation and used to estimate normal depth, appear to grossly overestimate bankfull discharge, resulting in a difference in percent flow of 100%, 3) Stoke's Law was incorrectly used to calculate particle settling velocity, and 4) methods used to calculate the deposition rate targets should be relative to the desired conditions.

Again, this first "critical technical error" is an editorial error and can be rectified easily with a correction.

The second "critical technical error" mistakenly assumes that the normal depth was estimated using the Manning's equation. A quick examination of the spreadsheet (in the EPA's possession since September, 1998) would have shown that the normal depth calculations are directly entered into the spreadsheet. In this case, these values are based on field measurements conducted by EPA and IDEQ personnel in August, 1998.

The third "critical technical error" mistakenly assumes that Rubey's equation was not used to calculate the settling velocity. Again, a quick examination of the spreadsheet, or a phone call to IDEQ personnel, would have shown the reviewer that Rubey's equation was in fact used (see fall velocity attachment).

The fourth "critical technical error" cites that the reference shear stress is a critical component of this analysis and that it is based, in this case, on existing conditions rather than on desired conditions. The IDEQ wishes to stress that the reference shear stress used in the Middle Fork Payette TMDL was selected carefully and according to validation work conducted in similar conditions by Andrews and Nankervis (1995), and is supported by other observed reference shear stress values for D50 near 1.75 mm (Buffington, 1999). In addition to these supporting documents, an additional analysis was conducted for an extreme reference shear stress value, as reported by Buffington and Montgomery (1997). It can be seen that for a reference shear stress value of 0.073 ($\tau^* = 0.073$), the impact to the final analysis results is small (reference shear stress example).

In the second portion of the fourth "critical technical error", it appears that the EPA's desire is to select a reference shear stress relative to the desired conditions of the stream channel. The first part of the IDEQ's response is that the reference shear stress example shows how the choice of the reference shear stress does not change the final results to a great extent. The second part of the IDEQ's response is, as mentioned above, the sand present in the lower reaches may be a huge, transient artifact of the 1997 storm and may not be there under target or background conditions. And, while we all hope that the sand bars in the lower reaches will be gone when the effects of the 1997 storm diminishes, there remains great uncertainty as to what the conditions will be within these lower reaches when beneficial use support is achieved. This is one of the primary reasons why it is our recommendation that iterative or "phased" TMDL targets be established for the Middle Fork Payette.

Comparison between $\tau^*r = 0.0376$ and $\tau^*r = 0.072$

Reach	Suggested % abov Background	Background Rate of Deposit @ $\tau^*_r = 0.072$	Target Rate of Deposit @ $\tau^*_r = 0.073$	Deposited at Suggested % above Background
1	50	10	15	15
2	44	8	12	11
3	46	8	12	12
4	50	1	2	2
5	56	19	28	30
6	26	89	133	120
7	48	43	65	65

Comparison for reduction in transport capacity ($Q_b/30$)

Reach	Suggested % abov Background	Background Rate of Deposit @ $Q_b/30$	Target Rate of Deposit @ $Q_b/30$	Deposited at Suggested % above Background
7	48	225	338	347

Equation Used for Fall Velocity (see column K in spreadsheet)

$=SQRT(2/3*D_i*g*(\rho_s - \rho))/\rho)$

Source (1)	τ^*_{c50m} (2)	R^*_p (3)	D_{50m} (mm) (4)	σ_g (ϕ) (5)	ρ_s (kg/m³) (6)	Particle characteristics (7)
Shields (1936b)	0.037	8.6	1.56	0.59	1060	Very angular amber cuttings
	0.040	8.7	1.56	0.59	1060	Very angular amber cuttings
	0.042	9.1	1.56	0.59	1060	Very angular amber cuttings
Shields (1936b) and Wheaton (?) (unpublished report, n.d.)	0.029	14.3	1.77	0.78	1270	Subangular brown coal
	0.037	19.3	1.77	0.78	1270	Subangular brown coal
	0.038	21.3	1.88	0.72	1270	Subangular brown coal
	0.049	37.4	2.53	0.56	1270	Subangular brown coal
Shields (1936b)	0.029	14.9	0.85	0.23	2700	Very angular crushed granite
	0.034	28.5	1.23	0.23	2700 [2710]	Very angular crushed granite
	0.048	100	2.44	0.23	2700 [2690]	Very angular crushed granite
	0.036	6.1	0.36	0.30	4250 [4300]	Angular crushed barite
	0.035	54.5	1.52	0.35	4250 [4200]	Angular crushed barite
	0.041	121	2.46	0.22	4250 [4190]	Angular crushed barite
	0.043	140	2.76	0.41	4250 [4200]	Angular crushed barite
	0.046	216	3.44	0.16	4250 [4200]	Angular crushed barite
Gilbert (1914)	(0.050)	(221)	(4.94)	<0.26	2650 [2690]	Subrounded to subangular gravels from the Sacramento and American rivers
	(0.059)	(473)	(7.01)	<0.22	2650 [2690]	
Kramer (1932, 1935)	0.032	6.5	0.51	0.74	2650 [2700]	Well-rounded sand
	0.038	7.6	0.53	0.81	2650 [2700]	Well-rounded sand
	0.033	7.7	0.55	0.62	2650 [2700]	Well-rounded sand
Casey (1935a,b)	0.067	1.9	0.17	0.41	2650	Subangular to subrounded river sand
	0.051	3.1	0.26	0.42	2650	Subangular to subrounded river sand
	0.034	10.4	0.67	0.16	2650	Subangular to subrounded river sand
	0.034	15.8	0.87	0.17	2650	Subangular to subrounded river sand
	0.037	18.1	0.93	0.19	2650	Subangular to subrounded river sand
	0.040	30.2	1.27	0.20	2650	Subangular to subrounded river sand
	0.041	49.2	1.74	0.19	2650	Subangular to subrounded river sand
	0.038	79.6	2.47	0.22	2650	Subangular to subrounded river sand
USWES (1935)	(0.051)	(2.2)	(0.21)	0.32	2650	Subangular to angular Mississippi River sand
	(0.045)	(4.0)	(0.31)	0.53	2650	Subrounded to subangular Otay Creek sand
	(0.038)	(4.1)	(0.35)	0.37	2650	Subrounded to subangular Mississippi River sand
	(0.034)	(7.5)	(0.51)	0.82	2650	Angular to subrounded creek sand
	(0.036)	(7.6)	(0.52)	0.53	2650	Subrounded to rounded Mississippi River sand
	(0.036)	(7.9)	(0.54)	0.66	2650	Subangular to subrounded creek sand

Note: Values in rounded parentheses are for $\bar{D}_m$, rather than D_{50m}; see Table 1 note. ρ_s values in square brackets (Column 6) are actual sediment densities as reported by the original source, as opposed to those reported in Shields' [1936b,c, Fig. 6 (nonbracketed values)]; it is uncertain which of these two ρ_s values were used in Shields' calculations. Roundness terms (Column 7) from Russell and Taylor (1937) and Powers (1953).

Buffington J.M The legend of A.F. Shields
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MEASURED TOTAL SEDIMENT LOADS
(SUSPENDED LOADS AND BEDLOADS)
FOR 93 UNITED STATES STREAMS

By Garnett P. Williams, U.S. Geological Survey,

and David L. Rosgen, Wildland Hydrology Consultants

U.S. GEOLOGICAL SURVEY

Open-File Report 89-67

Denver, Colorado
1989

Table 3.--*Bedload particle-size distributions*--Continued

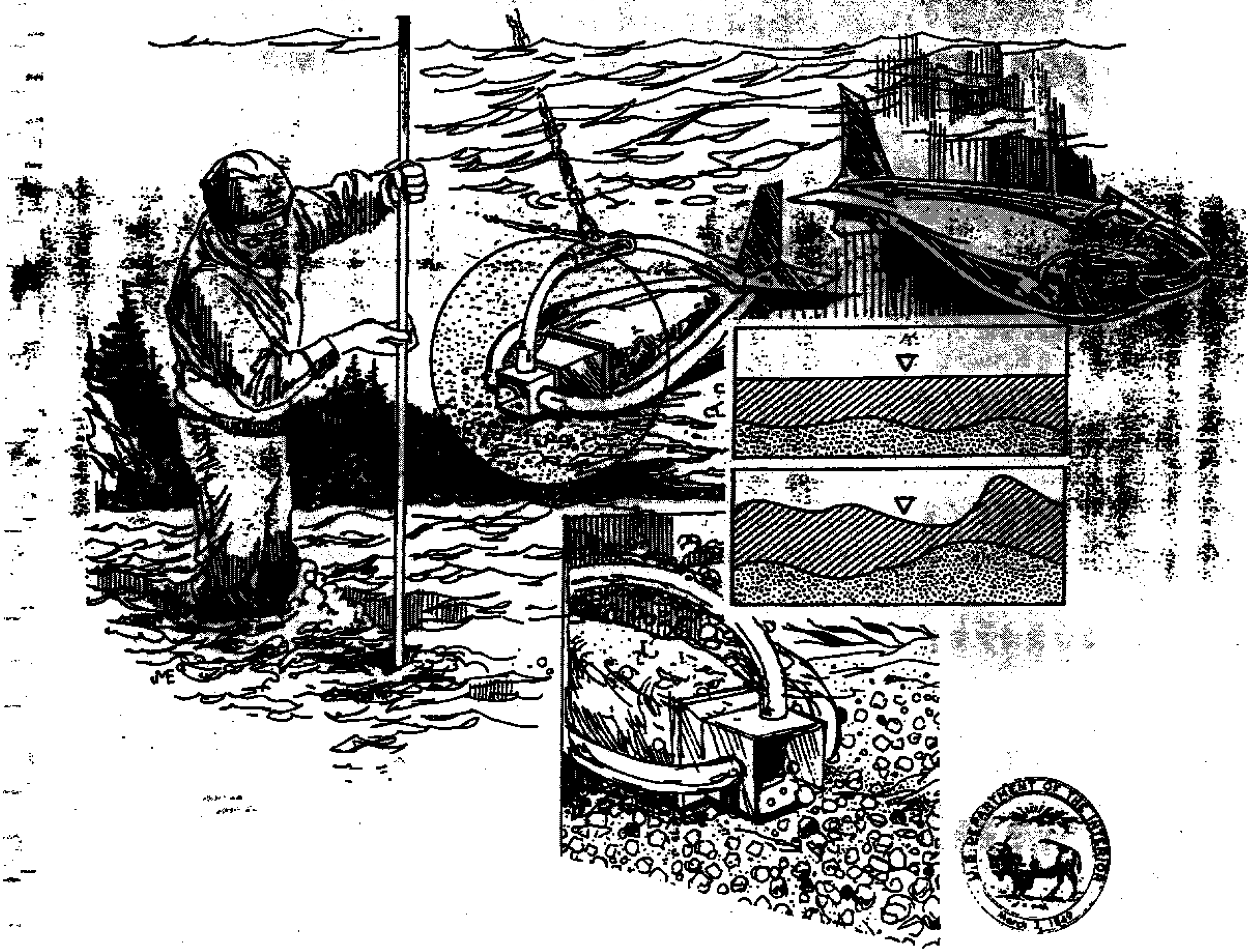
Date	Percent by weight finer than size (millimeters) indicated										
	0.062	0.12	0.25	0.5	1	2	4	8	16	32	64	128
52. Mad Creek (Site 3) near Empire, Colo.[6]												
06-06-84		0	2	7	24	49	71	87	96	100		
06-18-84			0	10	38	62	81	95	100			
06-25-84		0	2	8	28	52	62	72	78	100		
07-03-84			0	7	26	48	63	70	83	100		
07-12-84			0	7	30	57	77	87	100			
53. Middle Fork of Boulder Creek at Nederland, Colo.												
05-14-84			0	9	32	55	82	95	100			
05-17-84			0	22	56	78	100					
05-23-84			0	20	50	70	90	100				
06-04-84			0	10	30	60	90	100				
06-08-84			0	--	--	100						
06-15-84			0	11	28	44	67	83	100			
06-20-84			0	15	38	54	69	85	100			
06-27-84			0	11	44	67	89	100				
07-02-84			0	7	29	62	73	91	100			
07-11-84			0	9	27	45	73	82	100			
07-19-84			0	10	25	55	85	100				
07-27-84			0	11	39	72	89	100				
54. Jefferson Creek near Jefferson, Colo.												
05-16-84		0	4	19	41	63	81	93	100			
05-26-84			0	13	33	50	67	83	100			
06-07-84			0	9	27	45	64	82	100			
06-13-84			0	18	45	64	82	100				
06-28-84			0	15	38	54	77	92	100			
07-10-84			0	20	47	60	73	87	100			
07-25-84			0	10	25	47	73	92	100			
09-19-84			0	17	33	50	67	83	100			
55. Craig Creek near Bailey, Colo.												
04-16-84		0	14	42	85	85	99	100				
04-26-84		0	7	50	93	93	100					
04-30-84		0	4	21	96	96	100					
05-03-84		0	6	41	88	88	100					
05-10-84		0	5	32	92	92	100					
05-15-84	0	0.1	6	34	87	87	100					
05-17-84		0	5	29	77	77	97	99	100			
05-24-84		0	4	25	73	73	89	93	100			
05-29-84	0	0.4	4	36	84	84	98	100				
05-31-84	0	.4	8	38	92	92	99	100				
06-04-84	0	.6	7	37	86	86	98	100				
06-06-84	0	1	14	54	93	93	100					
06-11-84		0.	8	33	92	92	100					
06-19-84		0	10	40	90	90	100					
06-26-84		0	4	23	89	89	100					

ALAN BARTA

MEASURED TOTAL SEDIMENT LOADS (SUSPENDED LOADS AND BEDLOADS) FOR 93 UNITED STATES STREAMS

U.S. GEOLOGICAL SURVEY

Open-File Report 89-67



MF Payette bedload samples

Percent by weight finer that size indicated (mm)

Sample Date	<0.4	0.8	1.4	2	4	12	20	>20
3/5/98	10%	47%	63%	82%	96%	99%	100%	100%
3/17/98	10%	47%	63%	82%	96%	99%	100%	100%
3/25/98	6%	28%	38%	54%	82%	96%	100%	100%
4/15/98	3%	23%	37%	60%	90%	99%	100%	100%
4/25/98	6%	31%	47%	67%	90%	98%	100%	100%
5/8/98	4%	20%	33%	56%	86%	97%	100%	100%
5/28/98	5%	20%	30%	51%	86%	96%	100%	100%

Attachment 1: Detailed Reply to Comments Received from Tim Hamlin, US-EPA, Region 10 on the Draft Middle Fork Payette Sub-basin Assessment and TMDL

1. The target loads must be linked to water quality standards along with a demonstration on how these target loads will fully support beneficial uses.

The IDEQ acknowledges that an understanding of the linkages between narrative water quality standards and beneficial use support is required before beneficial use support can be achieved. However, limited or inappropriate data, coupled with time constraints, allowed only partial linkages to be developed for inclusion within the final TMDL. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate linkages, an additional section is included which outlines on going efforts to determine current conditions and improved linkages within the sub-basin.

Additional clarification on the IDEQ's response to this comment can be found in the following attachment (Attachment 2: IDEQ Internal Memo) and in the following excerpts of the final Middle Fork Payette TMDL:

Section 3.1.3.

...It is generally recognized that sediment input increases which result in observable changes in stream characteristics are detrimental to fisheries, however, it is extremely difficult to identify the point where these increases begin to affect reach deposition, transport capacity, and changes to particle size distributions (Chapman and McLeod, 1987; Potyondy et al, 1991). Prior to this TMDL, a threshold of 100% above background was selected as "excessive sediment" by the USDA Boise National Forest. This threshold was determined by an observation by Potyondy et al. (1991) that impacted conditions within the Middle Fork Payette River were a result of levels above background of as much as 200%. It was observed that these levels were too high based on the observed channel conditions. It was recommended to reduce these historical levels by 50%, or, in other words, set a threshold for sediment production to 100% above background sediment levels (Potyondy et al, 1991).

This TMDL is faced with a similar quandary as the Forest Service was when establishing a sediment production threshold. While it is apparent that the current levels of hillslope sediment production are "excessive" based on the support status of the lower reaches, the degree of excess sedimentation is difficult to quantify at this time. By selecting an increase in reach deposition of 50% over background as the load capacity it is recognized that improvements to the lower reaches will occur (i.e., the amount of sediment currently entering the impaired reaches would need be reduced by half). However, whether these improvements are great enough to meet beneficial use support, either on their own or through additional measures, is unknown at this time. Ongoing IDEQ beneficial use support status analysis, in combination within on going reconnaissance efforts and implementation plan development as described in Section 4, will identify whether the initial reductions established here are adequate for beneficial use support.

Section 3.2.3.

...These..(*sediment load allocations)*...are based on estimated average annual background sediment input rates entering the Middle Fork Payette River. Current cross-section geometries at selected points have been used to represent average reach conditions. These simplifications combine with the annual variability for flow and sediment input to make it unlikely that the exact deposition rates estimated here would ever be present within the Middle Fork Payette River. While it is apparent that the current levels of hillslope sediment production are "excessive" based on the support status of the lower reaches, the degree of excess sedimentation is difficult to quantify. By selecting an estimated increase in reach deposition of 50% over background it is recognized that the current sediment load will need to be reduced by half and that, through these reductions, improvements to the lower reaches will occur...

...A complete loading analysis, in conjunction with an implementation plan, lays out a general pollution control strategy and an expected time frame in which water quality standards will be met. For narrative criteria, e.g. sediment and nutrient, the measure of attainment of Idaho's water quality standards is full support of beneficial uses (IDEQb, 1998). Long recovery periods (greater than five years) are expected for implemented TMDLs dealing with non-point sediment sources...

...The Clean Water Act §303(d) specifies that, for those waters identified as water quality limited, a TMDL must be established "at a level necessary to implement the applicable water quality standards **with seasonal variations and a margin of safety** which takes into account any lack of knowledge concerning that relationship between...*these*...limitations and water quality" (emphasis added). This TMDL meets these requirements by establishing sediment targets within the Middle Fork Payette Sub-basin Assessment and TMDL in terms of a "percent above background" based on the **bankfull discharge** from the Middle Fork Payette River resolved into an estimated **annual background and current annual sediment load**. This means that the allocations established by this TMDL are in terms of a percent above background of the **annual sediment load**. Flexibility to quantify the load capacity and allocations in annual verses daily sediment loads is provided in 40 CFR Part 130.2(i). Note that the Middle Fork Payette River is an unregulated system, flows occur according to seasonal patterns and annual variations. Therefore, the annual allocations established reflect the Middle Fork Payette seasonal patterns and annual variations. The IDEQ asserts that if these sediment targets are attained the support of the beneficial uses will improve. Additionally, the IDEQ expects these sediment targets to be adjusted over time as progress towards beneficial use support is made and efforts to improved current sediment load estimations continue. Specific on going efforts to improve current sediment loads within the sub-basin are described more fully in Section 4.

Section 4.3

...As the draft IDEQ guidance for TMDL development states: *"a phased approach is often appropriate when nonpoint sources are a large part of the pollutant load, information is limited, or narrative criteria are being interpreted"* (IDEQb, 1998). Each of these considerations apply to the Middle Fork Payette TMDL. Under these circumstances there is a great deal of uncertainty in the loading analysis, load capacity and its allocation.

The draft IDEQ guidance for TMDL development suggests in these cases that: *"this uncertainty calls for a "ramping up" of implementation in which the more obvious sources of load reduction are scheduled for action first, with increasingly difficult and less cost effective load reductions scheduled further out in time. Essential to this strategy is gathering of information which will allow refinement of the loading analysis and document when restoration of beneficial uses occurs. The implementation schedule may be revised if additional data indicate an upward revision in the loading capacity (less load reduction required to meet beneficial uses then at first estimated), better than anticipated load reductions, or that water quality standards are met prior to full implementation"* (IDEQb, 1998).

2. Establish measurable targets so that responsible agencies and/or landowners will be able to decide where, how and by how much to reduce sediment.

The final TMDL establishes hillslope (i.e., land manager/owner) targets for the contributing areas of each impaired reach. These are presented in terms of a "percent above background" and "tons/year" based on background sediment production rates as estimated by BoiSed. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate benchmarks for target attainment, an additional section is included which outlines an implementation plan development strategy. The Watershed Advisory Group, along with designated responsible management agencies, is the designated entity required to develop the Implementation Plan and to ensure target attainment (i.e., beneficial use support).

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 3.2.3.
...As already stated, TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocation (WLA) for point sources and Load Allocation (LA) for nonpoint sources, including a margin of safety (MOS) and natural background conditions. And, the Middle Fork Payette TMDL addresses pollutant loading from nonpoint sources only. Allocations are presented for each of the impaired reaches of the Middle Fork Payette River. These allocations specify load capacities, target nonpoint management load allocations, and a margin of safety based on the estimated background loads for each of the contributing areas to the impacted reaches. The load allocation in terms of "percent above background" identified for each sub-watershed are estimated based on the portion of the total load that can be contributed by management activities...

...Table 12 summarizes the results of these transport capacity estimates for each reach analyzed. Reaches 5, 6, and 7 (see bold) are the impaired reaches. Load capacities and allocations are established for the contributing areas to these three reaches. The contributing area for Reach 5 includes the entire sub-basin area upslope and upstream of a point just downstream of the confluence between Lightning Creek and Middle Fork Payette River. The contributing area for Reach 6 includes the entire sub-basin area upslope and upstream of a point just upstream of the confluence between Anderson Creek and the Middle Fork Payette River. The contributing area for Reach 7 is the entire Middle Fork Payette sub-basin drainage...

...Current load estimates, also in terms of "percent above background", as estimated by the SedMod sediment production model (Glass, 1998) are presented in Table 14 to show preliminary sediment reductions required for the impaired reaches. Each of the required sediment reductions apply to the entire contributing areas of each of the impaired reaches...

...Land use and related activities within the Middle Fork consist of related timber harvest activities and recreations in all of the sub-watersheds except Pyle. Therefore, the allocations established for Reach 5 are for those activities related to timber harvesting and recreation. Allocations established for Reaches 6 and 7, which receives contributions from the Pyle sub-watershed, however, apply to agricultural, grazing, and urban nonpoint source activities in addition to timber harvest and recreation related nonpoint source activities. Table 15 shows the breakdown in acreage and in the proportional contributions of each of the identified activities within the Pyle sub-watershed that contribute to the nonpoint sediment load according to a proportioning analysis conducted using the Watershed Erosion Prediction Project (WEPP) model (Agricultural Research Service, 1997; Elliot et al, 1997; Flanagan and Livingston, 1995; IDEQa, 1998).

3. If there are areas where increasing the sediment load to the target percent above background would degrade existing quality, the State of Idaho Antidegredation Policy would need to be met.

Changes have been made in the final TMDL document to specify that land use activities within the Middle Fork Payette Sub-basin will continue to be conducted so that they comply with the State of Idaho Antidegredation Policy as stated in IDAPA 16.01.02.051.

Please note that reductions in sediment loads are required for each of the impaired reaches of the Middle Fork Payette River. Therefore, an increase in sediment load to the target percent above background is **not supported** by the current TMDL loading analysis and allocations. Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 3.2.3.
...Current load estimates, also in terms of "percent above background", as estimated by the SedMod sediment production model (Glass, 1998) are presented in Table 14 to show preliminary sediment reductions required for the impaired reaches. Each of the required sediment reductions apply to the entire contributing areas of each of the impaired reaches.

Table 14: Current Cumulative Sediment Loads, Cumulative Management Allocations, and Required Sediment Load Reductions*

Reach	Cumulative Current Load Estimate (% above bkgrnd)	Cumulative Management Allocation (% above bkgrnd)	Required Sediment Load Reduction (% above bkgrnd)
R1	35	35	0
R2	39	34	5
R3	62	33	29
R4	64	33	31
R5	**54**	**34**	**20**
R6	**67**	**32**	**35**
R7	**65**	**32**	**33**

*Current load estimate for percent above background based on SedMod (Boise Cascade, 1998).

4. The TMDL lacks an identifiable load allocation.

TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocation (WLA) for point sources and Load Allocation (LA) for nonpoint sources, including a margin of safety (MOS) and natural background conditions. The final TMDL submitted to the EPA by the IDEQ established Load Allocations (i.e., for nonpoint sources), a margin of safety, and natural background conditions for each of the impaired reaches in terms of a "percent above background" and tons/year based on background sediment production rates as estimated by BoiSed.

Please note that guidance for establishing load allocations for nonpoint pollutant sources by the EPA allows for "gross allocations" (US-EPA, 1991). The IDEQ would appreciate being notified if this guidance has been significantly changed by the US-EPA. Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 3.2.3., page 43
...Allocations are presented for each of the impaired reaches of the Middle Fork Payette River. These allocations specify load capacities, target nonpoint management load allocations, and a margin of safety based on the estimated background loads for each of the contributing areas to the impacted reaches. The load allocation in terms of "percent above background" identified for each sub-watershed are estimated based on the portion of the total load that can be contributed by management activities.

Where uncertainty exists (and this is almost always the case) about the amount of pollutant a water body can reasonably assimilate, federal law requires a margin of safety (MOS) be included in the calculations. The MOS may be numerical or be incorporated in conservative assumptions used to establish the TMDL. The MOS is intended to ensure that water quality goals will be met even though uncertainty in the loading capacity exists.

Table 12 summarizes the results of these transport capacity estimates for each reach analyzed. Reaches 5, 6, and 7 (see bold) are the impaired reaches. Load capacities and allocations are established for the contributing areas to these three reaches. The contributing area for Reach 5 includes the entire sub-basin area upslope and upstream of a point just downstream of the confluence between Lightning Creek and Middle Fork Payette River. The contributing area for Reach 6 includes the entire sub-basin area upslope and upstream of a point just upstream of the confluence between Anderson Creek and the Middle Fork Payette River. The contributing area for Reach 7 is the entire Middle Fork Payette sub-basin drainage...

5. The TMDL needs to consider all available data, such as the bacteria data collected in 1997, to make status calls using the Water Body Assessment Guidance.

The IDEQ evaluated the support status for all beneficial uses within the Middle Fork Payette Sub-basin by using the most complete data available at the time of document development. All water body assessments were made using available data received as a result of requests submitted to multiple agencies (e.g., USDA Boise National Forest, Boise Cascade Corp., IFO, IDWR, BOR, and USGS) on July 11, 1997 and are available in the IDEQ document support files. One bacteria samples was taken on September 11, 1997 that showed 560/100 ml colonies of fecal coliform. This level exceeds the primary contact recreation criteria for no more than 500/100 ml colonies of fecal coliform at any time. Since duration and frequency of the criteria exceedence is unknown, and the sample collected was found to be within 12% of the criteria, it was determined that this exceedence was minor and therefore does not downgrade the beneficial use.

For additional clarification, see Attachment 3 (Attachment 3: IDEQ Internal Memo) below.

6. The IDEQ must assess use support prior to removal from the 303(d) list, e.g., salmonid spawning in Scriver and Anderson Creeks.

The reason for the "Not Assessed" support status call for salmonid spawning on Scriver and Anderson Creeks is available in the IDEQ document support files. These two water bodies have a revised assessment of "Full Support" in the final TMDL document.

Please note that the "Not Assessed" support status call submitted in the Draft document was as a result of inadequate time for support status data review. This support status call was revised in the final document after further analysis by IDEQ staff. For additional clarification, see Attachment 3 (Attachment 3: IDEQ Internal Memo) below.

7. Present data to backup the full support of salmonid spawning status call in the lower Middle Fork Payette River.

These data are not available for those sections of the Middle Fork Payette River, and thus forces the IDEQ to make this assessment based on best professional judgement. The Data Gaps section within the final TMDL discusses these issues in more detail.

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 3.1.1.

...Most of the fishery information collected in this watershed are from the upland tributaries. Since the lower section of the Middle Fork of the Payette has relatively low numbers of fish, is not administered by Boise National Forest (who does most of the inventories in this area), and is dominated by non-game fish, it has not been intensively monitored. An inventory of juvenile species composition within the lower reach stream margins is also lacking at this time.

Obtaining this additional information on fish presence and usage would allow an improved diagnosis for the specific needs of designated and existing species within the lower reaches. This information is also needed to determine both the current baseline for cold water biota support and to provide a measure of beneficial use recovery. Because of these diagnostic and ongoing needs to determine cold water biota support status, it is evident that a fish inventory for both game and non-game fish in the lower Middle Fork Payette river is a data gap.

8. Please explain or clarify how the TMDL accounts for seasonal variation and critical conditions.

The Clean Water Act Section 303(d) specifies that, for those waters identified as water quality limited, a TMDL must be established "at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning that relationship between...*these*...limitations and water quality" (emphasis added). The final TMDL proposed by the IDEQ meets these requirements by establishing sediment targets in terms of a "percent above background" based on the bankfull discharge from the Middle Fork Payette River resolved into an estimated annual background and current annual sediment load. This means that the allocations established by this TMDL are in terms of a percent above background of the annual sediment load. Flexibility to quantify the load capacity and allocations in annual verses daily sediment loads is provided in 40 CFR Part 130.2(i). Note that the Middle Fork Payette River is an unregulated system, flows occur according to seasonal patterns and annual variations. Therefore, the annual allocations established reflect the Middle Fork Payette seasonal patterns and annual variations.

9. Include the basis for stream listings on the 303(d)list early in the sub-basin assessment.

Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 1

...In 1994 the EPA placed five tributaries and the mainstem of the Middle Fork Payette River on Idaho's 303(d) list as water quality limited due to excess sediment. These segments were carried forward to the 1996 list. The listed segments included: Anderson Creek, Lightning Creek, Scriver Creek, Bulldog Creek, Silver Creek, and the mainstem of the Middle Fork Payette River. All of the listed segments were located within the Boise National Forest and were determined to be water quality limited based on exceedences of the Boise National Forest Plan standards and guidelines (USDA, 1990) and best professional judgement. Guidance for listing water bodies as water quality limited provided by Region 10 of the EPA states that any determination of water quality limited status based on this type of exceedences and professional judgement can be re-examined (EPA, 1995)...

10. What was the basis for subwatershed ranking? How do these rankings fit into the sediment source assessment?

Changes have been made in the final TMDL document to address this comment.

Specifically, the subwatershed ranking was conducted at an inappropriate scale for the current analysis and was dropped from the final TMDL document.

11. Include a table which identifies both hill slope delivery and surface erosion delivery rates.

Changes have been made in the final TMDL document to address this comment.

Specifically, please refer to Table 1 in Appendix B, on page B3.

12. Where is streambank erosion active and what percentage of the sediment load is from bank erosion?

Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in the following section included in the final Middle Fork Payette TMDL:

Section 2.3.1.1.

...Field observations by IDEQ personnel have noted active streambank erosion in few isolated places within Reach 5 of the Middle Fork Payette River. The locations and amount of streambank erosion suggest that this erosion is a result of a high sediment load from the contributing area to Reach 5 and subsequent channel morphology change. The rate of erosion is a function of channel morphology change only. Therefore, it is thought that the percentage of the current sediment load due to bank erosion is not significant when compared to the sediment load from the contributing area to Reach 5.

13. Clarify monitoring by landowners, what and how do they interpret data?

Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 3.2.3

...Current load estimates, also in terms of "percent above background", as estimated by the SedMod sediment production model (Glass, 1998) are presented in Table 14 to show preliminary sediment reductions required for the impaired reaches. Each of the required sediment reductions apply to the entire contributing areas of each of the impaired reaches, for all times of the year, for all forms of sediment inputs to the Middle Fork Payette River.

Table 14: Current Cumulative Sediment Loads, Cumulative Management Allocations, and Required Sediment Load Reductions*

Reach	Cumulative Current Load Estimate (% above bkgrnd)	Cumulative Management Allocation (% above bkgrnd)	Required Sediment Load Reduction (% above bkgrnd)
R1	35	35	0
R2	39	34	5
R3	62	33	29
R4	64	33	31
R5	**54**	**34**	**20**
R6	**67**	**32**	**35**
R7	**65**	**32**	**33**

*Current load estimate for percent above background based on SedMod (Boise Cascade, 1998).

Land use and related activities within the Middle Fork consist of related timber harvest activities and recreations in all of the sub-watersheds except Pyle. Therefore, the allocations established for Reach 5 are for those activities related to timber harvesting and recreation. Allocations established for Reaches 6 and 7, which receives contributions from the Pyle sub-watershed, however, apply to agricultural, grazing, and urban nonpoint source activities in addition to timber harvest and recreation related nonpoint source activities. Table 15 shows the breakdown in acreage and in the proportional contributions of each of the identified activities within the Pyle sub-watershed that contribute to the nonpoint sediment load according to a proportioning analysis conducted using the Watershed Erosion Prediction Project (WEPP) model (Agricultural Research Service, 1997; Elliot et al, 1997; Flanagan and Livingston, 1995; IDEQa, 1998).

Table 15: Nonpoint Source Activity, Acres, and Proportion of load from the Pyle Sub-Watershed

Activity	Acres	Proportion of Sediment Load
Roads	471	97.4%
Pasture	5000	2.0%
Hay: 0-5% Slopes	1500	0.0%
Hay: 6-20% Slopes	500	0.4%
Urban	640	0.1%
New Construction: 0-5% Slopes	25	0.1%
New Construction: 6-20% Slopes	6	0.1%
Forest	11418	0.0%
Total	19560	100%

Note that the roads listed in this table are owned by a variety of agencies and are used for timber harvest, recreation, residence access, and agriculture and pasture access. Also note that the allocations specified for Reaches 6 and 7 include the entire contributing areas for each of these reaches, of which the Pyle sub-watershed composes a small portion. Refinement of these allocations will be required during the development of specific actions for sediment reductions during the implementation phase of this TMDL.

A complete loading analysis, in conjunction with an implementation plan, lays out a general pollution control strategy and an expected time frame in which water quality standards will be met. For narrative criteria, e.g.

sediment and nutrient, the measure of attainment of Idaho's water quality standards is full support of beneficial uses (IDEQb, 1998). Long recovery periods (greater than five years) are expected for implemented TMDLs dealing with non-point sediment sources. Because of the expected long term recovery periods, the Middle Fork Payette River TMDL allows for short term increases in sediment production as a result of restoration and timber management activities that will reduce overall sediment production in the long term. Water quality targets in these cases may be recommended by the IDEQ to ensure overall TMDL compliance...

Section 4.

...The draft IDEQ TMDL development guidance also suggests that monitoring to ascertain achievement of water quality goals is an essential part of implementation plans. Instream monitoring and assessment of water quality is to be done by IDEQ. Implementation monitoring will be done by designated state agencies as defined in IDAPA 16.01.02.003.23 (IDEQb, 1998).

Section 4.1

...Upon approval of this TMDL by EPA Region 10, a Middle Fork Payette River TMDL Implementation Plan will be developed by designated supporting agencies and stakeholders. The Idaho Water Quality Standards directs appointed basin and watershed advisory groups to provide public review on recommended actions to achieve the water quality target listed in the Middle Fork Payette River TMDL.

The Middle Fork Payette River TMDL Implementation Plan will aim to be the most appropriate plan for nonpoint sediment source pollution controls. The Plan will list activities which are to be implemented by land managers within the community to enhance the water quality of the Middle Fork Payette River. The Plan will include specific actions to meet the TMDL targets and a schedule for implementation of each activity. These activities might include, but are not limited to: forest road reconstruction, road closures, ongoing road maintenance programs, slide stabilization projects, riparian tree plantings, agricultural best management practices, bioengineering structures, wetland restoration, urban storm water system upgrades, development of a tax relief policy for riparian areas, development of an erosion control ordinance and education and information programs to increase community awareness of the river's water quality conditions and the activities to be undertaken to restore the river's water quality.

Section 4.2

...Idaho's short TMDL development schedule and the regulatory allowances point to phased or iterative TMDLs. In a phased TMDL much is yet unknown and the initial loading analysis may be inexact. The initial phase focuses on what is known. Progressive load reduction moves toward the eventual goal by targeting more obvious source problems in the implementation plan. Essential to this approach is inclusion, in the implementation plan, of a plan to gather the data needed to refine load estimates and their allocation. On going efforts to assess sediment loads within the Middle Fork Payette basin are presented here, with the caveat that these and other efforts will be better refined as the implementation plan is developed.

The IDEQ welcomes the assistance of other agencies, or private organizations, with the resources and interest in TMDL implementation plan development and on going efforts to assess current pollutant loads. Additionally, the IDEQ recognizes that many others hold information and expertise and encourage these agencies to work with the appointed Middle Fork Payette Watershed Advisory Group and stakeholders during TMDL development and implementation (IDEQb, 1998).

On going studies relevant to the Middle Fork Payette River Sub-basin in general, but not necessarily to the establishment of this TMDL, include: 1) baseline monitoring sites (USDA Forest Service, Boise National Forest); 2) Idaho Department of Water Resources Basin Plan; a d 3) IDEQ Bull Trout Problem Assessment. Additional on going studies relevant to the Middle Fork Payette River Sub-basin specific to sediment load

descriptions and analysis include: 1) a land slide inventory (Boise Cascade Corporation); 2) SedMod model application refinements and general model refinements; 3) Idaho Department of Lands Cumulative Effects Watershed Procedure; and 4) Middle Fork Payette River Sediment Trend Monitoring (EPA, IDEQ, and USDA Forest Service, Boise National Forest).
(Note: Additional ongoing studies are described in greater detail in Sections 4.2.1., 4.2.2., 4.2.3., and 4.2.4.)

14. The TMDL should establish a framework which specifically outlines the elements that need to be evaluated by land managers. These might include: surface and fluvial erosion and mass failure risk from proposed and existing impacts.

Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 4.1

Upon approval of this TMDL by EPA Region 10, a Middle Fork Payette River TMDL Implementation Plan will be developed by designated supporting agencies and stakeholders. The Idaho Water Quality Standards directs appointed basin and watershed advisory groups to provide public review on recommended actions to achieve the water quality target listed in the Middle Fork Payette River TMDL.

The Middle Fork Payette River TMDL Implementation Plan will aim to be the most appropriate plan for nonpoint sediment source pollution controls. The Plan will list activities which are to be implemented by land managers within the community to enhance the water quality of the Middle Fork Payette River. The Plan will include specific actions to meet the TMDL targets and a schedule for implementation of each activity. These activities might include, but are not limited to: forest road reconstruction, road closures, ongoing road maintenance programs, slide stabilization projects, riparian tree plantings, agricultural best management practices, bioengineering structures, wetland restoration, urban storm water system upgrades, development of a tax relief policy for riparian areas, development of an erosion control ordinance and education and information programs to increase community awareness of the river's water quality conditions and the activities to be undertaken to restore the river's water quality...

Section 4.2.1. (Landslide Inventory)

The need for an adequate prediction and planning tool to assess background and management induced rates of mass wasting was identified as a serious data gap during the development of this TMDL. However, the lack of appropriate historical data, combined with a lack of an adequate sub-basin reconnaissance for current land slide features, prevented the development of this prior to submittal of this TMDL.

In order to address this data gap, the Boise Cascade Corporation has begun to develop a GIS based land slide inventory data set on current and historical land slide events within the region (Glass, 1998). This effort is being conducted in cooperation with the USDA Forest Service, IDEQ, and others. Because the sediment reduction targets established by this TMDL include a mass wasting component, it is important for this effort to continue in a cooperative manner with all effected responsible land management agencies so that they may justify and defend their management actions within the Middle Fork Payette sub-basin.

Sectin 4.2.2. (Boise Cascade SedMod Model Improvements)

Improvements are in the process of being made to Boise Cascade's SedMod sediment prediction model. These improvements include a quality control check for stream initiation locations within the Middle Fork

Payette River sub-basin in addition to modifications to the SedMod model itself (Glass, 1998).

Section 4.2.3. (Idaho Department of Land's Cumulative Watershed Effects Procedure)

A Cumulative Watershed Effects (CWE) inventory is expected to be completed by the Idaho Department of Lands during the summer of 1999. Field data collection and reconnaissance was finished during the fall of 1998, review and data reduction is planning to be completed during the winter of 1999, with the final report to be available summer of 1999.

The CWE process was developed in order to meet antidegradation provision specified by the Clean Water Act. The concept of cumulative effects suggest that, while impacts from any single forest practice may not exceed Idaho water quality standards if BMPs are properly applied, impacts from a series of practices may add up to Idaho water quality standard exceedences. The CWE process is designed to first examine conditions in a watershed surrounding a stream, then attempts to identify causes of the conditions, and finally, to identify actions that will correct any identified adverse conditions. It is the identification of actions to correct identified adverse conditions that should prove especially useful to the Middle Fork Watershed Advisory Group during TMDL implementation plan development.

Section 4.2.4. (Middle Fork Payette River Sediment Trend Monitoring)

The purpose of the Middle Fork Payette River Sediment Trend Monitoring is to collect information on the surface water sediment conditions within the Middle Fork Sub-basin to: 1) isolate the form of sediment impairing beneficial uses (i.e., turbidity vs bedload impacts); 2) characterize existing sediment load trends; and 3) validate predictive sediment equations. This is a cooperative monitoring effort funded by the EPA and involving personnel from the EPA, IDEQ, and the USDA Forest Service. So far the data collected has provided: 1) stage:discharge relationships at two sites along the Middle Fork Payette River; 2) a general partitioning between suspended and bedload within the lower reaches of the Middle Fork Payette River; 3) the average particle size for captured bedload at two sites along the Middle Fork Payette River; 4) a general comparison between the bedload grain size captured and the substrate grain size at two sites along the Middle Fork Payette River; 5) estimated bedload vs discharge curves for two sites based on 11 bedload samples; and 6) estimated bedload vs discharge curves for 9 tributaries to the Middle Fork Payette River based on one bankfull discharge bedload measurement (Fitzgerald et al, 1998b).

15. The TMDL should estimate the existing and potential sources of sediment in the watershed to conceptualize the present condition of the river and establish the load reduction needed.

The IDEQ acknowledges that an understanding of the linkages between sediment sources and the present condition of the Middle Fork Payette River is required to identify specific actions for TMDL target attainment. In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides inadequate linkages, an additional section is included which outlines on going efforts to determine current conditions and an improved understanding of the linkages within the sub-basin.

Additional clarification on the IDEQ's response to this comment has been included in the document excerpt under Comment 14.

16. The TMDL needs to list all limitations and assumptions used in the loading analysis.

Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 4.2.2. (Model Application and Assumptions)
The Parker bedload equation is used in the Middle Fork Payette River TMDL loading analysis to develop an allowable rate of deposition above background. This model is an empirical model developed on streams with gravel substrates. Validation studies of the Parker model have been conducted in the Sierra batholith streams (Andrews and Nankervis, 1995). Because the Middle Fork Payette River is dominated by gravel size substrate in the lower reaches (i.e., D50 = 5 mm diameter) the Parker equation was determined to be appropriate. Assumptions used in the current application are as follows:

- Steady and uniform flow conditions at bankfull stage represents the two year (i.e., channel forming) flow.
- Channel roughness, slope, and geometry are uniform along each of the designated reaches.
- The sediment particle size distribution entering the tributaries and the Middle Fork Payette River is uniform throughout the sub-basin.

17. The TMDL needs to fully explain the modeling analysis and assumptions and qualify and quantify the effects theses assumptions have on the certainty of output.

Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in Attachment 4 and in the following excerpts from the final Middle Fork Payette TMDL:

Appendix B, Section 4.2.1.
An analysis of reach transport capacity was conducted using current reach geometry characteristics and background sediment levels. These background sediment levels were then increased until the rate of deposition within each reach was 50% above background deposition rates. Sediment transport for bedload used Parker's equation for uniform mobility for each particle size class (Parker, 1990; Kinerson, 1986; Wilcock et al, 1996; Andrews and Nankervis, 1995).

Table 1 presents the amount of background hillslope erosion estimated to enter the Middle Fork Payette River (see Amount Delivered, Table 1). These average annual sediment inputs were partitioned into particle size classes based on the Soil Survey of the Middle Fork Payette River Basin (USDA, 1976).

Beginning in the uppermost reach (Reach 1), background sediment input was totaled for each of the contributing sub-watersheds and routed through the reach. Those sediments that were shown to be output at the bottom of the first reach were then routed to the second reach as primary input. Tributary background sediment input from the contributing sub-watershed were then added to the primary input within the second reach and routed to the third reach. This pattern (i.e., adding the sediment routed down from upper reaches to the tributary inputs from the nearby sub-watersheds, then routing the total down to the next reach) was continued down until the confluence with the South Fork Payette River. Sediment input from the sub-watersheds was then increased until the deposition rate within each reach was 50% above the deposition rate during background input levels.

Certain inputs and results of the sediment transport capacity model were checked for each reach in order to determine how well the inputs and model fit within the Middle Fork Payette River system. These included a check on the channel geometry during the two-year flow, and a check on the observed verses the predicted medium particle size (i.e., D50) for the reach. The results of these checks are presented in Table 3.

Table 3: Parker Transport Capacity Model Input and Reach Medium Size Particle Check

Reach	Two-Yr Flow (cfs) (Provided)*	Two-Yr Flow (cfs) (Predicted)**	Percent Difference in Flow (%)	Medium Particle Size (mm) (Observed)	Medium Particle Size (mm) (Bkgrd)	(Target)
R1	13.2	11.5	-13	68	77	75
R2	16.2	12.2	-25	68	54	52
R3	36.7	30.5	-17	97	93	90
R4	42.9	47.9	12	119	116	113
R5	**58.6**	**58.8**	**0**	**38**	**41**	**40**
R6	**79.2**	**93.9**	**19**	**5**	**18**	**17**
R7	**89.4**	**79.2**	**-12**	**5**	**16**	**15**

*Based on Fitzgerald, 1998b
**Based on the Manning's Equation for the Q_2 channel cross-section (Richards, 1982; IDEQa, 1998).

18. Please explain why the Parker model was used for a sand bed streams.
Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in Attachment 4 and in the following excerpts from the final Middle Fork Payette TMDL:

Appendix B, Section 4.2.2.
The Parker bedload equation is used in the Middle Fork Payette River TMDL loading analysis to develop an allowable rate of deposition above background. This model is an empirical model developed on streams with gravel substrates. Validation studies of the Parker model have been conducted in the Sierra batholith streams (Andrews and Nankervis, 1995). **Because the Middle Fork Payette River is dominated by gravel size substrate in the lower reaches (i.e., D50 = 5 mm diameter) the Parker equation was determined to be appropriate**...(emphasis added)

19. Please explain why a 10% margin of safety is adequate.
Changes have been made in the final TMDL document to address this comment.

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 3.2.3.
...Allocations are presented for each of the impaired reaches of the Middle Fork Payette River. These allocations specify load capacities, target nonpoint management load allocations, and a margin of safety based on the estimated background loads for each of the contributing areas to the impacted reaches. The load allocation in terms of "percent above background" identified for each sub-watershed are estimated based on the portion of the total load that can be contributed by management activities.

Where uncertainty exists (and this is almost always the case) about the amount of pollutant a water body can reasonably assimilate, federal law requires a margin of safety (MOS) be included in the calculations. The MOS may be numerical or be incorporated in conservative assumptions used to establish the TMDL. The MOS is intended to ensure that water quality goals will be met even though uncertainty in the loading capacity exists...

...The Clean Water Act §303(d) specifies that, for those waters identified as water quality limited, a TMDL must be established "at a level necessary to implement the applicable water quality standards **with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning that** relationship between...*these*...limitations and water quality" (emphasis added). This TMDL meets these requirements by establishing sediment targets within the Middle Fork Payette Sub-basin Assessment and TMDL in terms of a "percent above background" based on the **bankfull discharge** from the Middle Fork Payette River resolved into an estimated **annual background and current annual sediment load**. This means that the allocations established by this TMDL are in terms of a percent above background of the **annual sediment load**. Flexibility to quantify the load capacity and allocations in annual verses daily sediment loads is provided in 40 CFR Part 130.2(i)...**The IDEQ asserts that if these sediment targets are attained the support of the beneficial uses will improve. Additionally, the IDEQ expects these sediment targets to be adjusted over time as progress towards beneficial use support is made and efforts to improved current sediment load estimations continue** (emphasis added). Specific on going efforts to improve current sediment loads within the sub-basin are described more fully in Section 4.

...It should be noted that the transport capacity model uses physical parameters and inputs that are not based on conservative assumptions, however, the load capacity specified includes not only surface erosion, but mass wasting contributions as well. Therefore, in addition to the margin of safety that has been applied, **the allocations are considered conservative due to the use of background estimates that include mass wasting.** (emphasis added).

Section 4.2.

Idaho's short TMDL development schedule and the regulatory allowances point to phased or iterative TMDLs. In a phased TMDL much is yet unknown and the initial loading analysis may be inexact. The initial phase focuses on what is known. Progressive load reduction moves toward the eventual goal by targeting more obvious source problems in the implementation plan. Essential to this approach is inclusion, in the implementation plan, of a plan to gather the data needed to refine load estimates and their allocation. On going efforts to assess sediment loads within the Middle Fork Payette basin are presented here, with the caveat that these and other efforts will be better refined as the implementation plan is developed.

The IDEQ welcomes the assistance of other agencies, or private organizations, with the resources and interest in TMDL implementation plan development and on going efforts to assess current pollutant loads. Additionally, the IDEQ recognizes that many others hold information and expertise and encourage these agencies to work with the appointed Middle Fork Payette Watershed Advisory Group and stakeholders during TMDL development and implementation (IDEQb, 1998)...

20. Update surface erosion estimates from SedMod to represent current conditions.

In order to address concerns that the final TMDL submitted to the EPA by the IDEQ provides an inadequate current condition assessment, an additional section is included which outlines on going efforts to determine current conditions within the Middle Fork Payette River sub-basin.

Additional clarification on the IDEQ's response to this comment can be found in the following excerpts from the final Middle Fork Payette TMDL:

Section 4.2.2. (Boise Cascade SedMod Model Improvements)

Improvements are in the process of being made to Boise Cascade s SedMod sediment prediction model. These improvements include a quality control check for stream initiation locations within the Middle Fork

Payette River sub-basin in addition to modifications to the SedMod model itself (Glass, 1998).

Attachment 2: IDEQ Internal Memo

March 3, 1999

MEMORANDUM

TO: Larry Koenig
Assistant Administrator

FROM: Steve West
Regional Administrator

SUBJECT: Middle Fork Payette River (justification for 50% above background)

As requested, we are providing the information regarding the 50% above background target which can be found on page 40 of the document. As you may recall, our original document contained a target for pool frequency per river mile. A decision was made to not include this target because of the link to habitat impairment which is not considered a pollutant by DEQ.

3.1.3. Sediment Transport Capacity

This TMDL establishes a target for sediment input in terms of "percent above background" based on a 50% increase in reach deposition rates over background deposition rates. These results are based on average annual background sediment input rates entering the Middle Fork Payette River. Current cross-section geometries at selected points have been used to represent average reach conditions. These simplifications combined with the annual variability for flow and sediment input to make it unlikely that the exact deposition rates **estimated** here would be present within the Middle Fork Payette River. New data, information, or model refinements to this approach will most likely lead to improvements in future applications.

It is generally recognized that increases in sediment input which result in observable changes in stream characteristics are detrimental to fisheries. However, it is extremely difficult to identify the point where these increases begin to affect reach deposition, transport capacity, and changes to particle size distributions (Chapman and McLeod, 1987; Potyondy et al, 1991). Prior to this TMDL, a threshold of 100% above background was selected as "excessive sediment" by the USDA Boise National Forest. This threshold was determined by an observation by Potyondy et al. (1991) that impacted conditions within the Middle Fork Payette River were a result of levels above background of as much as 200%. It was observed that these levels were "excessive" based on the observed channel conditions. It was recommended to reduce these historical levels by 50%, or, in other words, set a threshold for sediment production to 100% above background sediment levels (Potyondy et al, 1991).

> This TMDL is faced with a similar quandary when establishing a sediment production threshold. While it is apparent that the current levels of hillslope sediment production are "excessive" based on the support status of the lower reaches, the degree of excess sedimentation is difficult to quantify at this time. By selecting an increase in reach deposition of 50% over background as the load capacity it is recognized that improvements to the lower reaches will occur (i.e., the amount of sediment currently entering the impaired reaches would need to be reduced by half). However, whether these improvements are great enough to meet beneficial use support, either on their own or through additional measures, is unknown at this time. **Ongoing IDEQ beneficial use support status analysis, in combination with on going reconnaissance efforts and implementation plan development as described in Section 4, will identify whether the initial reductions established here are adequate for beneficial use support.**

Emphasis has been added to highlight the fact that the reduction specified is based on an estimate of the reductions necessary. It is our opinion that the 50% above background target is conservative, based on the observations made by the forest service, and comments received from the Boise Cascade Corporation agree with this position. Emphasis has been added to the last sentence from the document because this represents the "feedback loop" where additional information will become available to refine the original estimates. "Adaptive management" of the watershed is needed where additional restoration may be appropriate should the target not be sufficient to meet beneficial uses.

In summary, we believe the approach taken in the document is consistent with "40 CFR 130.2(g) *Load Allocation (LA)*. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading."

If we can provide any other information, please let us know.

cc: Bill Gale
Craig Shepard
Bob Steed
Mike McIntyre
Johanna Luce

Attachment 3: IDEQ Internal Memo

DIVISION OF
ENVIRONMENTAL QUALITY

1445 North Orchard, Boise, ID 83706-1255,(208) 373-0502 Philip E. Batt, Governor

M E M O R A N D U M

to: Johanna Luce
from: Robert Steed
subject: Middle Fork Payette Assessment Calls.
date: April 21, 1999

After receiving comments on the Middle Fork Payette River TMDL regarding assessment of Salmonid Spawning on Anderson Creek and Scriver Creek, and the bacteria data on Anderson Creek, I have decided to continue assessment, past original state. This memo contains the justification for my actions.

The reason for the original "Not Assessed" salmonid spawning assessments
Anderson Creek has had limited fishery monitoring. There are basically four programs going on that would include fish monitoring for this water body. The first program is the Forest Service's aquatic survey and aquatic survey data base. A good portion of Anderson Creek is on non-Forest Service land and was not included in this survey. The second program is a past program by Forest Service called the Baseline Inventory. The Baseline Inventory is predominantly dominated by habitat measures and lacks actual measurement of fish. The narrative conclusion from the only site on Anderson Creek states that Anderson Creek is "Very poor fish habitat". It is important to remember that this assessment was done in 1986, after recent fires in this watershed, also "Very poor fish habitat" is a subjective call based on a single site with out actual fisheries information to determine actual fish use. The third program is monitoring performed by Idaho Fish and Game, independent studies. No fish and game studies had been performed in this watershed. The final, fourth, program is Idaho Division of Environmental Quality's Beneficial Use Reconnaissance Project. Anderson Creek was monitoring through this program once in 1993, twice in 1996, and once in 1997. A fish inventory was performed at only one of these sites in 1996. This inventory was performed in the lower reaches of Anderson Creek and found Rainbow Trout (O. mykiss) and Sculpin (Cottidae). The fish survey shows that there were multiple age classes of Salmonid, which clearly indicate that salmonid spawning is occurring, there isn't really enough samples, time electrofishing, collected to determine the strength of the population to determine a high confidence level in salmonid spawning status. For this reason we originally selected "Not Assessed" for salmonid spawning status.

On the other hand Scriver Creek was probably assessed as "Not Assessed" accidentally. Forest Service's Baseline Inventory Found "Spawning Success" in 1986. Boise National Forest's Aquatic Survey Data Base shows Multiple age classes of both Rainbow and Brook Trout. There is no reason to believe Salmonid Spawning is anything but "Full Support"

The revised assessments
The revised assessment for salmonid spawning in both Anderson Creek and Scriver Creek is "Full Support". DEQ Boise Regional Office believes that water quality is not limiting salmon spawning in Anderson Creek

and Scriver Creek, and has made a commitment to further investigate the strength of the populations, in the Summer of 1999. It is my understanding that if Salmonid Spawning is found to be limited, TMDL type actions will be immediately taken.

Bacteria Data on Anderson Creek.
In 1997 while working on the Sub-basin Assessment for Middle Fork Payette River, someone stated that they were more worried about bacteria in Anderson Creek than anything else. We took a single bacteria sample from Anderson Creek from immediately above it's confluence with Middle Fork Payette River. Again One sample was taken on September 11 which is in the sampling window for primary contact recreation (May 1 to September 30). The sample exceeded the primary contact recreation criteria of 500/100 mL at any time, but not enough samples were taken to determine if 30 day period and geometric criteria had been exceeded. Although the sample exceeded a portion of the criteria, 560/100 mL, the samples exceedance is not at alarming levels. Since duration and frequency of exceedances are unknown and exceedance is not at an alarming level it was determined that this exceedance was minor and therefore does not downgrade the beneficial use. It may prove prudent to further examine bacterial levels in Anderson Creek.

Attachment 4: Responses to Additional Questions from Jim Fitzgerald, US-EPA

Question 1. *The text cites Parker (1990), however, is appears the analysis uses Parker (1982) equation, is this correct?*

Yes, the equation used was Parker, 1982. This version was taken from the validation Andrews and Nankervis (1995) did in the Sierra Nevada batholith.

Question 2. *For critical shear stress (τ^*_c), was significant particle motion or first motion assumed? A requirement of the Parker equation is that initial particle motion be considered if surface particle sizes are used, and phi is calculated using:* $\phi i = \tau^*/(1.18*\tau^*_c)$

The D_{50} considered in this model is the D_{50} of the bedload. See the answer to questions 4 and 6 to understand how this is done.

Question 3. *Where did constants to calculate τ^*_r come from (need citation)?*

The critical shear stress used is based on citations in peer-reviewed, published literature for granitic geology in the Sierra Nevada (Andrews and Nankervis, 1995).

Question 4. *How was the input D_{50} determined which set the reference shear stress (τ^*) for the Parker potential movement calculations? And, is this value assumed to be the approximate D_{50} under background conditions or is it based on the existing conditions?*

The D_{50} is both the result of the transport and affects the amount of transport. These must be consistent for each geometry, input amount, and particle size distribution modeled. Therefore, the D_{50} used was determined through iteration. The final D_{50} used was then compared with current observations of D_{50} for model validation. The D_{50} is relatively insensitive to the amount of input and particle size distribution, but is sensitive to channel geometry. This is because the transport rate is extremely sensitive to the D_{50} (i.e., a relatively small change in the D_{50} results in a large change in the channel transport rate).

Question 5. *The mass per velocity column in the spreadsheet lists (Q_i/V_i), is there a Q_i or should it be Q_{bi}?*

Yes, this was a typo. It should be Q_{bi}. The answer remains the same.

Question 6. *How is (Q_b/V) (tons/meter) related to the substrate grain size distribution? This answer may be covered in one of the cited references. Because of the "gray" nature of some of the literature could DEQ provide a copy of the following references to help EPA expedite their review of the analysis: 1) Kinerson (1986); and 2) Andrews and Nankervis (1995)?*

$$F_{bi} = \frac{Q_{bi}/V_i}{\sum Q_{bi}/V_i}$$

Where F_{bi} is the fraction of the bed in the i^{th} size class.

I am certain that Ned Andrews would disagree with your classification of his paper as "gray". Andrews and Nankervis (1995) was peer-reviewed and published in an American Geophysical Union Monograph called "The Wolman Volume." Kinerson (1986) is a masters thesis. Copies of both of these papers can be found with Charlie Luce and Alan Barta at the Rocky Mountain Research Station, Boise, ID. Also, note that the units within the Excel spreadsheets are metric, not english.

Question 7. *The deposition rates presented in Table 12 (main document), and Table 4, 11, and 12 (Appendix B) list different deposition rates. EPA assumes that the values listed in the spreadsheets are the actual numbers. Will this discrepancy change the final load capacities and allocations presented in the TMDL?*

The differences between the values in the main document and those presented in Appendix B are that those in the main document are presented in English units and those in the appendix are in metric units (NOTE THE TONS/YR VS THE TONNES/YR IN THE COLUMN HEADINGS). The EPA can select either value, as long as you understand the associated units...your choice.

Question 8. *What is the citation for the particle fall velocity calculation?*

Richards (1982). I believe it is Stokes Law.

Question 9. *Why is percent capacity used calculated for only the 1.4 to the 362 grain sizes?*

The calculation was only used as a diagnostic when initially writing the spreadsheet and is not used for any further calculations. Consequently it was not updated to reflect the fact that the summation needed to handle smaller size fractions in lower gradient reaches.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

Reply To
Attn Of: OW-134 June 17, 1999

Stephen West
Idaho Division of Environmental Quality
1445 N. Orchard
Boise, Idaho 83706

Dear Mr. West,

I understand there is interest in having follow up discussions regarding the Middle Fork Payette River and Lower Boise River TMDLs to resolve issues we discussed in our April 23 meeting. We share your interest in wrapping up these decisions as soon as possible.

To make sure we are clear on the critical issues as they currently stand, and ensure that future discussions are as effective as possible, I thought it would be valuable if EPA re-stated the options we offered in our earlier meetings (see attachments). If IDEQ could follow by providing a description of the approach you intend to take, and what specific issues need further discussion, we should be in a position to quickly resolve these differences, or be clear where we cannot agree.

Please contact Leigh Woodruff (378-5774) to set up a follow-up meeting.

Sincerely,

for Timothy Hamlin, Manager
Water Quality Unit

cc: Michael McIntyre, IDEQ
Dave Mabe, IDEQ

Attachments (2)

Attachment A

MF Payette River TMDL Options

Option 1.

This option builds on the current approach outlined in the TMDL, and consists of four additional elements. In combination we believe these would make the TMDL approvable:

a. additional rationale would be provided explaining how achieving the target deposition rate would achieve full support of coldwater biota and salmonid spawning uses (explanation provided to date, including reference to the USFS 100% above background target, does not establish such a linkage);
b. additional hillslope targets would be established for each watershed process (mass wasting, surface erosion, bank erosion, etc.) by subwatershed to help direct implementation activities. EPA would be willing to work with IDEQ to identify and establish appropriate targets;
c. specific commitments would be included in the TMDL to monitor improvements in water quality, including a time line for conducting monitoring; and
d. a more comprehensive feedback loop process would be established in the TMDL including a schedule for completing the implementation and monitoring plans, conducting monitoring, assessing data, and a description of what will be done if the TMDL is not on track. One approach used in other TMDLs is to establish specific check in points, such as at 2, 5, 10, 15 yrs., etc. so that expectations are clear, and implementation, monitoring and evaluation can be more effectively planned.

Option 2.

This option consists of using a surrogate approach to setting TMDL targets:

a. Desired instream conditions would be used to set measurable goals. Potential surrogates include: surface fines by textural facies; residual pool volume (i.e., volume of fine sediment stored in pools0; and pool frequency and depth (building on the existing pool survey of the impaired reach). Target levels could be set using upstream reaches meeting beneficial uses, and/or the USFS natural conditions database; and
b. using sediment transport curves to set measurable and realistic bed-material load reductions.

Provisions c. and d. from Option 1 would also apply.

Option 3.

This options consists of using natural background sediment loading as a target for the TMDL. This option is predicated on the presumption that beneficial uses would be fully supported at natural background sediment loading rates. EPA recognizes that there are other factors contributing to beneficial use impairment (e.g., elevated water temperature). The expectation is that reducing the sediment load will benefit specific aspects of the water quality problems, and that beneficial uses are likely to be fully supported at some point above natural background. Ongoing monitoring would be used to establish when full support is achieved, thereby achieving the goal of the TMDL.

Provisions c. and d. from Option 1 would also apply.

Attachment B

Lower Boise River TMDL Sediment Issues Summary

Through discussions with IDEQ staff and others, it appears that solutions can be developed to address concerns raised with regard to bacterial WLA's for Nampa, Meridian, and Wilder, and allocations for sediment and bacteria for the Lower Boise River riparian area. These issues are not fully resolved, but analysis is underway and amendments to the TMDL are being drafted which we believe will satisfactorily address EPA's concerns.

Agreement has not been reached over concerns raised by EPA in the draft and final TMDL regarding the sediment TSS targets. In summary, our concerns have been:

- There is no information to substantiate that the water column TSS targets will resolve salmonid spawning impairments resulting from inadequate substrate conditions.
- Data from studies cited in the Sediment Problem Assessment suggests that adverse effects to sensitive life stages of salmonids and non-salmonids occur at TSS concentrations well below the 50 mg/l and 80 mg/l TSS targets established in the TMDL.

We believe there are three additions to the TMDL which would resolve these concerns:

1. IDEQ commitment to participate (not necessarily financially) in a study to evaluate the adverse effects of TSS in the Lower Boise River using in situ techniques, and use the results of the study to modify the targets if appropriate. There appears to be general agreement that such a study is valuable, and discussions have begun to outline the study, identify funding , etc. EPA has committed $5,000 to this effort.

2. Commitment to conduct follow up monitoring to characterize bedload (no data currently exists) and substrate conditions. Such data would be used to refine or establish TMDL targets. Two meetings have been held amongst various agencies to develop this plan, and a draft of the plan should be circulated amongst the WAG, USGS, DEQ, BOR and EPA within one week. EPA has committed $5,000 and staff support to this effort.

3. Addition of substrate targets (e.g. cobble embeddedness, surface fines, etc.) into the TMDL which would allow full support of salmonid spawning. It is expected that different targets would be set for different reaches of the river to reflect geomorphologic changes and changes in salmonid species usage, ie. trout – whitefish. These targets would not change the current allocations or % sediment reductions needed.

Currently there is no commitment from IDEQ for any of these elements, but there seems to be general agreement on the value of a. and b. Incorporation of substrate targets into the TMDL appears to be the most problematic.

STEPHEN WEST
BOISE REGIONAL OFFICE

STATE OF IDAHO
DIVISION OF
ENVIRONMENTAL QUALITY

1410 North Hilton • Boise, Idaho 83706-1253 • (208) 373-0502

Dirk Kempthorne, Governor
C. Stephen Allred, Administrator

December 23, 1999

Tim Hamlin, Water Quality Unit Manager
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

RECEIVED
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DIVISION OF
ENVIRONMENTAL QUALITY
BOISE REGIONAL OFFICE

RE: Middle Fork Payette River TMDL

Dear Mr. Hamlin:

This letter is in response to your June 17, 1999 letter regarding conditions for approval of the Middle Fork Payette River TMDL, submitted to EPA on December 31, 1998. This follows up meetings between DEQ and EPA on April 23 and August 12, 1999 to discuss EPAs concerns and their final resolution. We agree that your concerns are important, and upon careful consideration have prepared the following response, which we trust will result in EPA approval.

The DEQ agrees that a surrogate for the effect of sediment loading in the Middle Fork Payette River is useful and is the most reasonable and expeditious way to address EPAs concerns about the linkage between load reductions and attainment of water quality standards. In the interest of speedy resolution, the changes regarding use of a surrogate are incorporated in this letter rather than a revised document. Our discussions with EPA indicate that this format is acceptable.

> The DEQ recognizes the desirability of better links between prescribed load reductions, attainment of water quality standard and support of uses. However, we have found the science does not currently exist to provide solid quantitative links when sediment is the pollutant. In order to address concerns over such a link, to provide more of a bridge between sediment load reductions and support of beneficial uses, DEQ will use a surrogate measure for the Middle Fork Payette River TMDL.
>
> Based on DEQ's analysis of beneficial use support, it is our determination that the nature of impairment within the lower reaches (below Big Bulldog Creek) of the Middle Fork Payette River is a loss of adequate winter cover and migration habitat provided by deep pools. Therefore, with this letter, DEQ establishes a revised TMDL target framework for the Middle Fork Payette River, and sets a interim surrogate target of an increase in pool frequency within these lower reaches to an average of 2 pools, with a residual depth $\geq$ 1.3 meters deep per km, and a minimum of no less than 3 such pools in any 3 km stretch.

The value for this target is chosen based on comparisons to nearby Bear Valley Creek as upstream reaches of the MF Payette itself, due primarily to changes in gradient, are uncharacteristic of the potential further downstream in the impaired reach.

Setting a target for pool residual depth is a surrogate measure of sediment load. It is based upon the way in which sediment loading is affecting beneficial uses in the lower Middle Fork Payette, and reinforces the specified bedload transport reduction. The values specified are interim and subject to change when additional site-specific data support the need for revision. A pool inventory has been completed and will be fully evaluated with regard to revision of the target upon approval of the TMDL and establishment of a watershed advisory group (WAG). It is anticipated this will occur in spring of 2000.

Any revisions to the MF Payette TMDL will be provided in writing to EPA and all other recipients of the originally submitted document. The nature of the written revision — letter, appendix, substitute chapters — will be determined at the time of revision based upon the extent of the changes and clarity of record. The DEQ will also maintain a record of any changes in its files.

The target framework establishes the desired pool frequency (stated above) as the primary instream target for the Middle Fork Payette TMDL in order to achieve beneficial use support. We believe this surrogate provides a readily measured water quality goal for gaging improvement in over-wintering and migration habitat and the effectiveness of sediment load reductions.

Secondarily, methods to increase the frequency of deep pools are also identified. These methods include a decrease in sediment production from hillslope land use activities in the upper portions and tributaries of the Middle Fork (MF) Payette basin and possible instream structure construction. The later is identified as an option to be considered in implementation because it is recognized the load reductions alone may not suffice to achieve the pool frequency target. Such direct measures are not prescribed by the TMDL.

We believe addition of a desired frequency of deep pools as a surrogate does all that should be expected or is needed at this time to bridge the gap between sediment reduction and recovery of beneficial uses in the MF Payette. We maintain that this surrogate is site-specific, thus not applicable elsewhere without analysis of conditions in that other locale. We believe it is a measurable goal that provides a more practical gage of the trajectory of water quality restoration in the MF Payette than modeling or measurement of sediment loads alone. However, it is not a substitute for the load reductions laid out in the TMDL and is not, by itself, a measure to determine whether individual activities are in compliance or allowable under the TMDL. Prescribed reductions in hillslope sediment loads are to serve that purpose.

> The DEQ further asserts that the definitive measure of compliance with Idaho's narrative criteria is support of beneficial uses. This we determine through direct biological assessment. At such time as full support of uses is determined to occur the surrogate target and further load reductions becomes moot.

In addition to the above, corrections to tables need to be made to the TMDL proper. The affected tables are as follows:

- Revised Tables 12,13, and 14 in the main document
- Revised Tables 4, 5, and 10 in Appendix B
- Correct Tables 11a through 12g, bed sediment transport spreadsheets, for Appendix B

The attached table revisions reflect conversion from metric tonnes to English tons. The attached tables 11a through 12g are what appeared in the draft TMDL, correcting a mistake made by inserting an earlier version in the final document. Please take the above indented text and these attachments as amendments to Middle Fork Payette River TMDL.

The 1998 TMDL document specifies hillslope sediment targets for each of the contributing areas to the impaired reaches. The DEQ believes these hillslope sediment targets, in combination with the pool frequency target specified in this letter, are adequate to meet the requirements of the Clean Water Act. It was our understanding, subsequent to our meeting on April 23, 1999, that EPA did as well.

The addition of a surrogate target was presented as option two in EPA's letter of June 17, 1999. We note that you specified four provisions, a-d, under option two in that letter. Our recollection of our April 23, 1999 discussion with EPA is that option two would consist of only provision a, specification of desired instream conditions, as addressed above.

Provisions b, c, and, d of your June 17, 1999 came as a surprise to DEQ. As discussed on Aug 12, 1999, the remainder of this letter addresses DEQ's response to those three additional provisions, provided for the administrative record only, not as amendment to the TMDL.

Provision b. "using sediment transport curves to set measurable and realistic bed-material load reductions."

> The DEQ commits to participate in a study to evaluate the use of sediment transport curves to establish a better linkage between hillslope sediment targets and desired conditions in the lower reaches of the Middle Fork Payette River. The extent of this participation will be limited to staff time. Upon completion of the study, the DEQ agrees to evaluate the results and determine whether or not the current hillslope sediment targets are appropriate and to use the results of the study to modify the targets if appropriate. This commitment does not mean DEQ endorses sediment transport curves as the only means to set meaningful goals for sediment load reductions.

Provision c. "specific commitment would be included in the TMDL to monitor improvements in water quality, ..."

This provisions speaks to what DEQ intends to cover in the implementation plan and goes beyond what is currently required in a TMDL. We do intend to continue BURP monitoring on a regular five cycle in accordance with current DEQ program goals. This will include the MF Payette River. Furthermore, in setting a surrogate as a measurable goal DEQ will monitor that surrogate in the MF Payette River as well. However, further details of monitoring specific to the MF Payette River will be addressed in the implementation plan (see below).

Provision d. This provision basically requests more detail on a feedback loop for TMDL revision.

Much of what EPA seeks here will be addressed in a separate and subsequent implementation plan. Therefore no additions, addenda, or errata are made to the current TMDL on this matter.

By state law DEQ is obligated to work with local stakeholders and designated land management agencies in the development of implementation plans to control non-point source pollutants. In accordance with current DEQ program guidance ("Guidance for Development of Total Maximum Daily Loads", a copy of which has been provided to you) such a plan for the Middle Fork Payette River TMDL is to be completed within 18 months of final EPA approval. That guidance provides considerable detail as to the content of an implementation plan. We also have plans to develop a companion implementation plan guidance document which will more specifically address TMDL revision.

The DEQ recognizes, as does EPA, that development of most TMDLs will be an iterative process and that any TMDL can and should be revised based upon better information or analysis. This is addressed in DEQ's TMDL guidance document as well. We fully intend to make use of new and better information to improve all our TMDLs, our public demands it. We have made a specific commitment to do so in the present case in response to provision b above. However, it must be recognized by all that our ability to revise any TMDL is constrained by a heavy workload in developing round 1 TMDLs for the next six years, at least.

We believe we have been reasonable in reaching resolution of your conditions to the best of our ability at this time. Please accept this letter and its attachments as our formal response to your concerns, and, where indicated, amendment to the Middle Fork Payette TMDL. We look forward to your final approval of that TMDL and moving on to cooperative efforts in the actual work of implementation.

Sincerely,

David J Mabe

David Mabe
State Water Quality Program Administrator

DM:de:lg

Enclosure

cc: Randall Smith, EPA Reg 10, Director Office of Water
Leigh Woodruff, EPA Idaho Operations Office, TMDL Coordinator
Stephen West, DEQ Boise Regional Administrator
Michael McIntyre, DEQ Surface Water Program Manager
Don Essig, DEQ TMDL Program Manager

Subbasin Assessment and Total Maximum Daily Load for the Middle Fork Payette River
(Submitted December, 1998)
Errata

Page 43, Table 12

Table 12: Sediment Input Rate Results by Reach

Reach	Background Input Entering MF Payette (tons/yr)	Background Rate of Deposition (tons/yr)	Target Rate of Deposition (tons/yr)	Load Capacity (% above background)	Cumulative Load Capacity* (% above background)
R1	103	6.1	9.1	50	50
R2	35	6.3	9.4	44	48
R3	96	4.3	6.4	46	47
R4	23	0.9	1.3	50	47
R5	76	17.9	26.8	56	49
R6	61	39.5	59.2	26	45
R7	75	32.5	48.7	48	46

*Based on increases to BoiSed background amounts delivered to each stream reach.

Page 44, Table 13

Table 13: Load Capacity, MOS, and Management Targets

Reach	Cumulative Load Capacity (% above background)	Cumulative Load Capacity (tons/yr)	Cumulative Background Load (tons/yr)	Cumulative Margin of Safety (tons/yr)	Cumulative Management Allocation (tons/yr)	Cumulative Management Allocation (% above bkgrd)
R1	50	4624	3083	462	1079	35
R2	48	5566	3761	557	1248	33
R3	47	10125	6888	1013	2224	32
R4	47	11762	8002	1176	2584	32
R5	49	13377	8978	1338	3061	34
R6	45	14960	10317	1496	3147	31
R7	46	16746	11470	1675	3601	31

Page 45, Table 14:

Table 14: Current Cumulative Sediment Loads, Cumulative Management Allocations, and Required Sediment Load Reductions*

Reach	Cumulative Current Load Estimate (% above bkgrnd)	Cumulative Management Allocation (% above bkgrnd)	Required Sediment Load Reduction (% above bkgrnd)
R1	35	35	0
R2	39	33	6
R3	62	32	30
R4	64	32	32
R5	54	34	20
R6	67	31	36
R7	65	31	34

*Current load estimate for percent above background based on SedMod (Boise Cascade, 1998).

Page B9, Table 4 (Appendix B):

Table 4: Sediment Input Rate Results by Reach

Reach	Background Input Entering MF Payette (tons/yr)	Background Rate of Deposition (tons/yr)	Target Rate of Deposition (tons/yr)	Load Capacity (% above background)	Cumulative Load Capacity* (% above background)
R1	103	6.1	9.1	50	50
R2	35	6.3	9.4	44	48
R3	96	4.3	6.4	46	47
R4	23	0.9	1.3	50	47
R5	76	17.9	26.8	56	49
R6	61	39.5	59.2	26	45
R7	75	32.5	48.7	48	46

*Based on increases to BoiSed background amounts delivered to each stream reach.

Page B9, Table 5 (Appendix B):

Table 5: Load Capacity, MOS, and Management Targets

Reach	Cumulative Load Capacity (% above background)	Cumulative Load Capacity (tons/yr)	Cumulative Background Load (tons/yr)	Cumulative Margin of Safety (tons/yr)	Cumulative Management Allocation (tons/yr)	Cumulative Management Allocation (% above bkgrd)
R1	50	4624	3083	462	1079	35
R2	48	5566	3761	557	1248	33
R3	47	10125	6888	1013	2224	32
R4	47	11762	8002	1176	2584	32
R5	49	13377	8978	1338	3061	34
R6	45	14960	10317	1496	3147	31
R7	46	16746	11470	1675	3601	31

Page B12, Table 10 (Appendix B):

Table 10: Current Cumulative Sediment Loads, Cumulative Management Allocations, and Required Sediment Load Reductions*

Reach	Cumulative Current Load Estimate (% above bkgrnd)	Cumulative Management Allocation (% above bkgrnd)	Required Sediment Load Reduction (% above bkgrnd)
R1	35	35	0
R2	39	33	6
R3	62	32	30
R4	64	32	32
R5	54	34	20
R6	67	31	36
R7	65	31	34

*Current load estimate for percent above background based on SedMod (Boise Cascade, 1998).

Pages B13-26, Tables 11 and 12 (Appendix B):

(see attached Excel sheets)

Table 11a Reach 1 Transport Capacity Under Background Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	16
Slope - S (m/m)	0.0101
Wetted Perimeter - P (m)	16.9
Cross Section Area to WS - A (m^2)	10.4
Hydraulic Radius - R (m)	0.62
Depth of Scour = 1/3 R	0.21
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	61.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*) (m/s)	0.09873
Median Grain Size - d50 (mm)	75
Percent of Bed < 1.4 mm	4%
Percent of Bed < 2.8 mm	8%
Percent of Bed < 5.7 mm	14%
Percent of Bed < 11 mm	43%

GEOMETRY CHECK	
Manning's n	0.066
Flow (cms)	11.5
Adc (m^2)	76.5
Flow (cms)	13.3
Percent Difference	-0.13

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	76.5
Bkgnd (T/km^2)	17
Mgmt (% abv Bkg)	0%
Mgmt (T/km^2)	0.0
Background	95
Management	0

Input Particle Sizes min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13%	12.04
0.25	0.5	13%	12.04
0.5	1	13%	12.04
1	2	13%	12.04
2	4	10%	9.26
4	8	16%	14.82
8	16	6%	5.56
16	32	5%	4.63
32	64	5%	4.63
64	128	2%	1.85
128	256	2%	1.85
256	512	2%	1.85
		100%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

τ*median (dimless)	T* median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.81E-02	3.76E-02	1.78961	0.02014	6.33E-05	0.00	2.68E+00	2.32E+03

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	T*i ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi Qbi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	9.14E-05	530.418	1.1E+01	1.00E-02	176.219	1.58E-01	423.54	0.044	Yes
0.25	0.5	0.4	1.83E-04	266.319	1.1E+01	9.97E-03	175.801	1.57E-01	422.61	0.063	Yes
0.5	1	0.7	3.63E-04	133.215	1.1E+01	9.93E-03	173.396	1.54E-01	416.81	0.089	Yes
1	2	1.4	7.27E-04	67.136	1.1E+01	9.37E-03	167.883	1.50E-01	403.43	0.125	No
2	4	2.8	1.44E-03	33.708	1.0E+01	9.05E-03	158.794	1.42E-01	383.48	0.177	No
4	8	5.7	2.87E-03	16.924	9.0E+00	8.08E-03	141.854	1.27E-01	342.52	0.251	No
8	16	11	5.71E-03	8.497	7.1E+00	6.40E-03	112.266	1.00E-01	271.12	0.355	No
16	32	23	1.14E-02	4.266	4.3E+00	3.86E-03	67.733	6.06E-02	163.58	0.502	No
32	64	45	2.28E-02	2.142	1.3E+00	1.14E-03	20.093	1.80E-02	48.52	0.709	No
64	128	91	4.31E-02	1.076	6.9E-03	6.15E-06	0.110	9.82E-05	0.27	1.003	No
128	256	181	8.98E-02	0.540	5.1E-07	4.61E-10	0.000	7.24E-09	0.00	1.419	No
256	512	362	1.79E-01	0.271	5.8E-16	5.33E-13	0.000	8.19E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qb/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
0.2	0	12	Suspended	Suspended	12	0	Suspended	Suspended	Suspended	0%	
0.4	0	12	Suspended	Suspended	12	0	Suspended	Suspended	Suspended	0%	
0.7	0	12	Suspended	Suspended	12	0	Suspended	Suspended	Suspended	0%	
1.4	0	12	403	58	12	0	12.838	8.19E-06	4%	4%	
2.8	0	9	391	55	9	0	9.260	6.68E-06	4%	8%	
5.7	0	15	343	48	15	0	14.816	1.18E-05	6%	14%	
11.3	0	5	271	38	4	0	5.556	5.65E-06	3%	17%	
22.6	0	5	164	23	5	0	4.630	7.80E-06	4%	22%	
45.3	0	5	49	7	5	0	4.630	2.61E-05	14%	36%	75
90.5	0	2	0	0	0	2	0.038	5.96E-05	21%	57%	
181.0	0	2	0	0	0	2	0.000	5.96E-05	21%	79%	
362.0	0	2	0	0	0	2	0.000	5.96E-05	21%	100%	
			Total 1675			Total 5.3	% Cap Used: 18%	Sum = 1.3E-04			D50 75 mm

Table E1b. Reach 2 Transport Capacity Under Background Conditions

REACH HYDRAULIC PARAMETERS AND CONSTANTS

Channel Width - w (m)	16
Slope - S (m/m)	0.0045
Wetted Perimeter - P (m)	16.3
Cross Section Area to WS - A (m^2)	11.5
Hydraulic Radius - R (m)	0.71
Depth of Scour = 1/3 R	0.24
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - th (Pa)	43.0
Density of Sediment - rhos (kg/m^3)	2300
Shear Velocity (U*)(m/s)	0.08484
Median Grain Size -D50 (mm)	51
Percent of Bed < 2.4 mm	9%
Percent of Bed < 2.8 mm	13%
Percent of Bed < 5.7 mm	20%
Percent of Bed < 51 mm	24%

HYDROMETRY CHECK

Manning's n	0.06
Flow (cms)	17.2
Adr (m^2)	90
Flow (cms)	16.2
Percent Difference	0.23

TRIBUTARY INPUT TO REACH

Adr (mi^2)	11.5
Mgrad (T/mi^2)	2.4
Mgmt (% abv Bkg	0%
Mgmt (T/mi^2)	0.0
Background	32
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	4.16
0.25	0.5	13.00%	4.16
0.5	1	13.00%	4.16
1	2	13.00%	4.16
2	4	10.00%	3.20
4	8	16.00%	5.12
8	16	6.00%	1.92
16	32	5.00%	1.60
32	64	5.00%	1.60
64	128	2.00%	0.64
128	256	2.00%	0.64
256	512	2.00%	0.64
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

U*median (dimless)	t*s median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
3.35E-07	3.36E-02	1.36916	0.33345	7.64E-05	0.00	3.37E+00	2.87E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*i ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	1.31E-01	392.221	1.1E+01	6.33E-03	97.173	1.02E-01	273.93	0.044	Yes
0.25	0.5	0.4	2.61E-04	196.920	1.1E+01	6.29E-03	96.267	1.01E-01	273.37	0.063	Yes
0.5	1	0.7	5.21E-04	98.874	1.1E+01	6.17E-03	94.479	9.94E-02	268.30	0.089	No
1	2	1.4	1.04E-03	49.443	1.0E+01	5.94E-03	90.998	9.57E-02	258.40	0.125	No
2	4	2.8	2.07E-03	24.925	9.6E+00	5.31E-03	84.336	8.87E-02	239.35	0.177	No
4	8	5.7	4.11E-03	12.514	6.2E+00	4.72E-03	72.256	7.60E-02	205.19	0.251	No
8	16	11	8.19E-03	6.283	6.0E+00	3.41E-03	52.196	5.49E-02	148.22	0.355	No
16	32	23	1.63E-02	3.155	2.9E+00	1.65E-03	25.210	2.65E-02	71.61	0.502	No
32	64	45	3.25E-02	1.584	4.2E-01	2.41E-04	3.692	3.88E-03	10.48	0.709	No
64	128	91	6.47E-02	0.795	9.3E-05	5.30E-08	0.001	8.53E-07	0.00	1.003	No
128	256	181	1.29E-01	0.399	1.7E-08	9.92E-12	0.000	1.60E-10	0.00	1.419	No
256	512	362	2.57E-01	0.200	7.8E-11	4.45E-14	0.000	7.17E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/t)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Q/Vi	% of Bed From Particles in Motion	cumulativ % in Bed	Approx D50
0.2	12	4	Suspended	Suspended	16	0	Suspended	Suspended	Suspende	0%	
0.4	12	4	Suspended	Suspended	16	0	Suspended	Suspended	Suspende	0%	
0.7	12	4	268	64	16	0	16.198	1.96E-05	4%	4%	
1.4	12	4	258	62	16	0	16.198	2.03E-05	5%	9%	
2.8	9	3	240	57	12	0	12.460	1.69E-05	4%	13%	
5.7	15	5	205	49	20	0	19.936	3.15E-05	7%	20%	
11.3	6	2	148	35	7	0	7.476	1.64E-05	4%	24%	
22.6	5	2	72	17	6	0	6.230	2.83E-05	6%	30%	
45.3	5	2	10	3	3	4	2.302	7.74E-05	17%	48%	52
90.5	0	1	0	0	0	1	0.001	7.74E-05	17%	65%	
181.0	0	1	0	0	0	1	0.000	7.74E-05	17%	83%	
362.0	0	1	0	0	0	1	0.000	7.74E-05	17%	100%	
			Total 1202			Total 5.7	% Cap Used, 11%	Sum = 4.5E-04			

121.33 mm

Table 11c. Reach 1 Transport Capacity Under Background Conditions

REACH HYDRAULIC PARAMETERS AND CONSTANTS

Channel Width - w (m)	22
Slope - S (m/m)	0.00874
Wetted Perimeter - P (m)	22.4
Cross Section Area to WS - A (m^2)	19.6
Hydraulic Radius - R (m)	0.88
Depth of Scour = 1/3 R	0.29
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	75.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.10956
Median Grain Size - d50 (mm)	89
Percent of Bed < 1.4 mm	4%
Percent of Bed < 2.8 mm	8%
Percent of Bed < 5.7 mm	14%
Percent of Bed < 11 mm	17%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	30.5
Adr (m^2)	170
Flow (cms)	36.7
Percent Difference	-0.17

TRIBUTARY INPUT TO REACH

Adr (mi^2)	89
Bkgrnd T/mi^2	1.1
Mgmt (% abv Bkg)	0%
Mgmt (T/mi^2)	0.0
Background	87
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	11.30
0.25	0.5	13.00%	11.30
0.5	1	13.00%	11.30
1	2	13.00%	11.30
2	4	10.00%	8.69
4	8	16.00%	13.90
8	16	6.00%	5.21
16	32	5.00%	4.35
32	64	5.00%	4.35
64	128	2.00%	1.74
128	256	2.00%	1.74
256	512	2.00%	1.74
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

F*median (dimless)	f*s median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
3.01E-07	2.76E-02	1.33693	0.10429	3.29E-04	0.00	7.60E+00	6.57E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	F's ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/s)	Parker Potential Volume Qbi (bi*w (m^3/s))	Potential Mass Qbi M(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	7.71E-05	654.976	1.1E+01	1.37E-02	169.369	3.01E-01	811.38	0.044	Yes
0.25	0.5	0.4	1.54E-04	327.347	1.1E+01	1.36E-02	168.417	2.99E-01	806.82	0.063	Yes
0.5	1	0.7	3.06E-04	164.335	1.1E+01	1.35E-02	166.313	2.95E-01	797.80	0.089	Yes
1	2	1.4	6.09E-04	82.320	1.1E+01	1.32E-02	162.830	2.89E-01	780.06	0.125	No
2	4	2.8	1.21E-03	41.432	1.0E+01	1.26E-02	155.645	2.76E-01	745.64	0.177	No
4	8	5.7	2.42E-03	20.802	9.3E+00	1.15E-02	142.075	2.52E-01	680.61	0.251	No
8	16	11	4.82E-03	10.445	7.7E+00	9.54E-03	117.788	2.09E-01	564.28	0.355	No
16	32	23	9.59E-03	5.244	5.2E+00	6.41E-03	79.097	1.40E-01	378.87	0.502	No
32	64	45	1.91E-02	2.633	2.1E+00	2.56E-03	31.654	5.61E-02	151.45	0.709	No
64	128	91	3.80E-02	1.322	9.2E-02	1.14E-04	1.403	2.49E-03	6.73	1.003	No
128	256	181	7.57E-02	0.664	7.9E-06	9.10E-09	0.000	1.99E-07	0.00	1.419	No
256	512	362	1.51E-01	0.333	3.1E-09	3.85E-12	0.000	8.42E-14	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Rolled (tonnes/yr)	mass/velocity Qb/Vi	% of Bed From Particles in Motion	Cumulative % in Bed	Approx. D50
0.2	16	11	Suspended	Suspended	27	0	Suspended	Suspended	Suspended	0%	
0.4	16	11	Suspended	Suspended	27	0	Suspended	Suspended	Suspended	0%	
0.7	16	11	Suspended	Suspended	27	0	Suspended	Suspended	Suspended	0%	
1.4	14	15	780	155	21	0	77.491	1.95E-05	4%	4%	
2.8	12	9	786	148	31	0	71.150	1.35E-05	4%	8%	
5.7	20	14	681	135	24	0	55.640	2.72E-05	6%	14%	
11.3	7	5	564	112	12	0	12.690	1.23E-05	3%	17%	
22.6	6	4	379	73	11	0	10.175	1.53E-05	3%	20%	
45.3	1	4	151	30	7	0	6.847	2.47E-05	6%	26%	
90.5	0	2	7	1	1	0	1.336	1.09E-04	25%	51%	89
181.0	0	2	0	0	0	2	0.000	1.09E-04	25%	75%	
362.0	0	2	0	0	0	2	0.000	1.09E-04	25%	100%	
			Total 3308			Total 3.9	% Cap Used: 0%	Sum = 4.4E-04			

D50 89 mm

Table 11d. Reach 4 Transport Capacity Under Background Conditions

REACH HYDRAULIC PARAMETERS AND CONSTANTS

Channel Width - w (m)	33
Slope - S (m/m)	0.01618
Wetted Perimeter - P (m)	33.3
Cross Section Area to WS - A (m^2)	19.1
Hydraulic Radius - R (m)	0.57
Depth of Scour = 1/3 R	0.19
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	91.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*b)(m/s)	0.17069
Median Grain Size - d50 (mm)	116
Percent of Bed < 1.4 mm	6%
Percent of Bed < 2.8 mm	11%
Percent of Bed < 5.7 mm	19%
Percent of Bed < 11 mm	23%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	42.9
Adt (m^2)	192
Flow (cms)	42.9
Percent Difference	0.13

TRIBUTARY INPUT TO REACH

Adt (mi^2)	11
Bkgmd T/mi^2	1.9
Mgmt (% abv Bkg)	0%
Mgmt (T/mi^2)	0.0
Background	21
Management	0

Input Particle Sizes min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	2.70
0.25	0.5	13.00%	2.70
0.5	1	13.00%	2.70
1	2	13.00%	2.70
2	4	10.00%	2.08
4	8	16.00%	3.33
8	16	6.00%	1.25
16	32	5.00%	1.04
32	64	5.00%	1.04
64	128	2.00%	0.42
128	256	2.00%	0.42
256	512	2.00%	0.42
		100.00%	

PARKER EQUATIONS TOTAL BEDLOAD TRANSPORT

T*median (dimless)	U*s median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.32E-02	3.76E-02	1.25487	0.05104	8.41E-05	0.00	7.49E+00	6.47E+02

PARKER SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	T*s ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*b?)
0.125	0.25	0.2	5.97E-05	398.930	1.1E+01	1.84E-02	348.744	6.08E-01	1638.90	0.044	Yes
0.25	0.5	0.4	1.19E-04	306.631	1.1E+01	1.83E-02	348.160	6.03E-01	1628.46	0.063	Yes
0.5	1	0.7	2.37E-04	199.142	1.1E+01	1.81E-02	346.982	5.90E-01	1613.43	0.088	Yes
1	2	1.4	4.72E-04	99.986	1.1E+01	1.78E-02	334.701	5.87E-01	1583.80	0.125	No
2	4	2.8	9.40E-04	50.204	1.0E+01	1.71E-02	322.494	5.65E-01	1524.03	0.177	No
4	8	5.7	1.87E-03	25.205	9.6E+00	1.59E-02	299.221	5.24E-01	1415.91	0.251	No
8	16	11	3.73E-03	12.655	8.3E+00	1.36E-02	258.767	4.50E-01	1215.02	0.355	No
16	32	23	7.43E-03	6.354	6.0E+00	9.89E-03	184.236	3.26E-01	881.23	0.502	No
32	64	45	1.48E-02	3.190	2.9E+00	4.83E-03	90.886	1.59E-01	430.07	0.709	No
64	128	91	2.95E-02	1.602	4.5E-01	7.35E-04	13.840	7.43E-02	65.49	1.003	No
128	256	181	5.87E-02	0.804	1.1E-04	1.79E-07	0.003	5.91E-06	0.02	1.419	No
256	512	362	1.17E-01	0.404	1.9E-08	3.20E-11	0.000	1.06E-09	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
0.2	27	3	Suspended	Suspended	30	0	Suspended	Suspended	Suspended	0%	
0.4	27	3	Suspended	Suspended	30	0	Suspended	Suspended	Suspended	0%	
0.7	27	3	Suspended	Suspended	30	0	Suspended	Suspended	Suspended	0%	
1.4	27	3	1524	144	30	0	30.309	1.01E-01	6%	6%	
2.8	21	2	1376	139	21	0	23.230	8.32E-06	5%	11%	
5.7	14	3	1416	129	17	0	37.368	1.42E-05	8%	19%	
11.3	13	1	1215	110	14	0	33.938	6.20E-06	4%	23%	
22.6	11	1	881	80	12	0	11.813	7.12E-06	4%	27%	
45.3	7	1	430	39	8	0	2.002	9.91E-06	6%	33%	
90.5	1	0	65	4	2	0	1.352	1.45E-05	9%	43%	116
181.0	0	0	0	0	0	0	0.001	4.91E-05	29%	71%	
362.0	0	0	0	0	0	0	0.000	4.91E-05	29%	100%	
			Total 7118			Total 0.0	% Cap Used, 11%	Sum = 1.7E-04			

D50 116 mm

Table F1e. Reach 5 Transport Capacity Under Background Conditions

REACH INPUT PARAMETERS

Channel Width - w (m)	25
Slope - S (m/m)	0.00109
Wetted Perimeter - P (m)	26.1
Cross Section Area to WS - A (m^2)	32.2
Hydraulic Radius - R (m)	1.23
Depth of Scour = 1/3 R	0.41
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	37.4
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (tb/rho)^0.5 (m/s)	0.07715
Median Grain Size - d50 (mm)	41
Percent of Bed < 1.4 mm	10%
Percent of Bed < 2.8 mm	14%
Percent of Bed < 5.7 mm	33%
Percent of Bed < 11 mm	37%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	38.8
Adr (mi^2)	245
Flow (cms)	38.6
Percent Difference	0.00

TRIBUTARY INPUT TO REACH

Adr (mi^2)	53
Mgmt Tons/mi^2	1.3
Mgmt (% the Bkg)	0%
Mgmt (T/mi^2)	0.0
Background	69
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	9.00
0.25	0.5	13.00%	9.00
0.5	1	13.00%	9.00
1	2	13.00%	9.00
2	4	10.00%	6.92
4	8	16.00%	11.07
8	16	6.00%	4.15
16	32	5.00%	3.46
32	64	5.00%	3.46
64	128	2.00%	1.38
128	256	2.00%	1.38
256	512	2.00%	1.38
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

T*median (dimless)	T*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
5.40E-02	3.76E-02	1.43745	0.21108	8.43E-05	0.00	6.23E+00	5.38E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	T*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi Qbi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? [Ws > U*k/2]
0.125	0.25	0.2	1.66E-04	226.304	1.3E+01	4.80E-03	42.038	1.21E-01	320.76	[illegible]	Yes
0.25	0.5	0.4	3.30E-04	162.833	1.1E+01	4.73E-03	41.367	1.20E-01	323.01	0.061	Yes
0.5	1	0.7	6.57E-04	93.308	1.1E+01	4.64E-03	40.440	1.17E-01	315.87	0.089	No
1	2	1.4	1.31E-03	41.375	1.0E+01	4.43E-03	38.843	1.12E-01	301.98	0.129	No
2	4	2.8	2.60E-03	28.369	9.3E+00	4.03E-03	35.443	1.01E-01	275.30	0.127	No
4	8	5.7	5.19E-03	16.418	7.7E+00	3.36E-03	29.373	8.46E-02	228.30	0.251	No
8	16	11	1.03E-02	5.251	5.2E+00	2.25E-03	19.698	5.67E-02	153.11	0.355	No
16	32	23	2.06E-02	2.826	2.1E+00	8.97E-04	7.850	2.26E-02	61.01	0.502	No
32	64	45	4.10E-02	1.319	9.0E-02	3.90E-05	0.341	9.83E-04	2.65	0.709	No
64	128	91	8.16E-02	0.662	7.1E-06	3.09E-09	0.000	7.80E-08	0.00	1.003	No
128	256	181	1.63E-01	0.332	3.1E-09	1.32E-12	0.000	3.33E-11	0.00	1.419	No
256	512	362	3.24E-01	0.167	2.9E-11	1.26E-14	0.000	3.17E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/h)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D10
0.2	30	9	Suspended	Suspended	39	0	Suspended	Suspended	Suspende	0%	
0.4	30	9	Suspended	Suspended	39	0	Suspended	Suspended	Suspende	0%	
0.7	30	9	316	127	39	0	39.193	3.10E-04	3%	3%	
1.4	30	9	302	121	39	0	39.195	1.15E-04	3%	10%	
2.8	23	7	276	111	30	0	30.130	9.71E-03	4%	14%	
5.7	17	11	218	93	28	0	28.340	1.87E-04	8%	23%	
11.3	14	4	153	62	18	0	18.090	3.05E-04	3%	25%	
22.6	12	3	61	25	15	0	15.075	3.19E-04	10%	27%	
45.3	8	3	3	1	1	10	1.064	3.57E-04	16%	33%	
90.5	2	1	0	0	0	1	0.000	3.57E-04	16%	68%	
181.0	0	1	0	0	0	1	0.000	3.57E-04	16%	84%	41
362.0	0	1	0	0	0	1	0.000	3.57E-04	16%	100%	
			Total 1338			Total 16.2	% Cap Used 59%	Sum = 3.3E-03			

D10 41 mm

Table 11F. Reach 8 Transport Capacity Under Background Conditions

HYDRAULIC GEOMETRY RESULTS AND CONSTANTS

Channel Width - w (m)	38
Slope - S (m/m)	0.001
Wetted Perimeter - P (m)	39
Cross Section Area to WS - A (m^2)	71
Hydraulic Radius - R (m)	1.79
Depth of Scour = 1/3 R	0.60
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	17.6
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*) (m/s)	0.13300
Median Grain Size - d50 (mm)	18
Percent of Bed < 1.4 mm	14%
Percent of Bed < 2.8 mm	21%
Percent of Bed < 5.7 mm	31%
Percent of Bed < 11 mm	44%

HYDROLOGY CHECK

Manning's n	0.035
Flow (cms)	95.0
Adr (m^2)	310
Flow (cms)	79.7
Percent Difference	0.19

TRIBUTARY INPUT TO REACH

Adr (mi^2)	83
Mgmt Tmt??	0.8
Mgmt (% of Bkg	0%
Mgmt (T/mi^2)	0.0
Background	31
Management	0

Input Particle Size min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	7.11
0.25	0.5	13.00%	7.11
0.5	1	13.00%	7.11
1	2	13.00%	7.11
2	4	10.00%	5.47
4	8	16.00%	8.75
8	16	6.00%	3.28
16	32	5.00%	2.74
32	64	5.00%	2.74
64	128	2.00%	1.09
128	256	2.00%	1.09
256	512	2.00%	1.09
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

T*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
5.28E-02	3.26E-02	1.33810	0.33433	4.94E-05	0.00	3.12E+00	4.43E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	T*s ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/s)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*sh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	3.76E-04	151.012	1.3E+01	1.32E-03	9.283	5.85E-02	158.08	0.044	Yes
0.25	0.5	0.4	7.48E-04	77.327	1.1E+01	1.49E-03	8.984	5.72E-02	154.33	0.063	No
0.5	1	0.7	1.49E-03	38.825	1.0E+01	1.42E-03	8.567	5.45E-02	147.07	0.089	No
1	2	1.4	2.97E-03	19.493	9.2E+00	1.29E-03	7.768	4.94E-02	133.39	0.125	No
2	4	2.8	5.91E-03	9.787	7.5E+00	1.05E-03	6.332	4.04E-02	109.12	0.177	No
4	8	5.7	1.18E-02	4.914	4.9E+00	6.83E-04	4.136	2.63E-02	71.03	0.251	No
8	16	11	2.34E-02	2.467	1.8E+00	2.52E-04	1.522	9.68E-03	26.15	0.355	No
16	32	23	4.67E-02	1.239	4.4E-02	6.10E-06	0.037	2.34E-04	0.63	0.502	No
32	64	45	9.30E-02	0.622	3.1E-06	4.32E-10	0.000	1.66E-08	0.00	0.709	No
64	128	91	1.85E-01	0.312	1.7E-09	2.40E-13	0.000	9.34E-12	0.00	1.003	No
128	256	181	3.69E-01	0.157	2.2E-11	3.00E-15	0.000	1.15E-13	0.00	1.419	No
256	512	362	7.35E-01	0.079	2.0E-12	2.76E-16	0.000	1.06E-14	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
0.2	39	7	Suspended	Suspended	46	0	Suspended	Suspended	Suspends	0%	
0.4	39	7	134	106	46	0	46.306	3.88E-04	5%	5%	
0.7	39	7	387	101	46	0	46.306	6.17E-04	5%	10%	
1.4	39	7	135	97	46	0	46.306	4.01E-04	4%	14%	
2.8	30	5	109	72	36	0	35.690	6.40E-04	5%	21%	
5.7	48	9	71	49	40	8	49.011	1.35E-03	11%	32%	
11.3	18	3	26	18	18	3	18.035	1.35E-03	11%	44%	
22.6	15	3	4	0	0	17	0.436	1.35E-03	11%	55%	18
45.3	1	3	0	0	0	4	0.000	1.35E-03	11%	66%	
90.5	0	1	0	0	0	7	0.000	1.35E-03	11%	77%	
181.0	0	1	0	0	0	1	0.000	1.35E-03	11%	89%	
362.0	0	1	0	0	0	1	0.000	1.35E-03	11%	100%	
			Total 642			Total 35.8	% Cap Used: 74%	Avg = 1.1E-03			

D50 18 mm

Table 11g. Reach 7 Transport Capacity Under Background Conditions

PRACTICE/FIELD CHARACTERISTICS AND CONSTANTS

Channel Width - w (m)	26.5
Slope - S (m/m)	0.00101
Wetted Perimeter - P (m)	28.2
Cross Section Area in WS - A (m^2)	47.5
Hydraulic Radius - R (m)	1.68
Depth of Scour = 4/3 R	0.56
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	16.7
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.05167
Median Grain Size - d50 (mm)	16
Percent of Bed < 1.4 mm	18%
Percent of Bed < 2.8 mm	24%
Percent of Bed < 5.7 mm	35%
Percent of Bed < 11 mm	46%

GEOMETRY CHECK

Manning's n	0.022
Flow (cms)	39.2
Adr (mi^2)	341
Flow (cms)	39.4
Percent Difference	-0.12

TRIBUTARY INPUT TO REACH

Adr (mi^2)	31
Regional T/mi^2	2.2
Mgmt (% abv Bkg)	0%
Mgmt (T/mi^2)	0.0
Background	68
Management	0

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	8.84
0.25	0.5	13.00%	8.84
0.5	1	13.00%	8.84
1	2	13.00%	8.84
2	4	10.00%	6.80
4	8	16.00%	10.88
8	16	6.00%	4.08
16	32	5.00%	3.40
32	64	5.00%	3.40
64	128	2.00%	1.36
128	256	2.00%	1.36
256	512	2.00%	1.36
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
6.31E-02	3.76E-02	1.68430	0.35083	2.13E-05	0.00	3.10E+00	4.48E+02

PARKER SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*i ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi Id(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	4.37E-04	148.554	1.1E+01	1.41E-03	9.032	3.74E-02	101.01	0.014	Yes
0.25	0.5	0.4	8.61E-03	73.301	1.1E+01	1.30E-03	8.836	3.85E-02	98.49	0.063	No
0.5	1	0.7	1.71E-03	36.944	1.0E+01	1.31E-03	8.390	3.47E-02	93.62	0.089	No
1	2	1.4	3.41E-03	18.349	9.1E+00	1.18E-03	7.571	3.13E-02	84.48	0.125	No
2	4	2.8	6.80E-03	9.311	7.4E+00	9.55E-04	6.126	2.53E-02	68.36	0.177	No
4	8	5.7	1.35E-02	4.670	4.7E+00	6.07E-04	3.890	1.61E-02	43.40	0.251	No
8	16	11	2.70E-02	2.348	1.6E+00	2.09E-04	1.335	5.53E-03	14.90	0.355	No
16	32	23	5.37E-02	1.179	2.4E-02	3.04E-06	0.020	8.06E-05	0.22	0.503	No
32	64	45	1.07E-01	0.592	1.6E-06	2.09E-10	0.000	5.55E-09	0.00	0.709	No
64	128	91	2.13E-01	0.297	1.3E-09	1.33E-13	0.000	4.03E-12	0.00	1.003	No
128	256	181	4.25E-01	0.149	1.7E-11	2.31E-15	0.000	5.87E-14	0.00	1.419	No
256	512	362	8.46E-01	0.075	1.0E-12	2.27E-16	0.000	6.01E-15	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/h)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mean/velocity QbVi	% of Bed From Particles in Motion	Cumulative % in Bed	Approx D50
			Suspended	Suspended	33	0	Suspended	Suspended	Suspended	1 0%	
0.2	46	9	98	107	33	0	55.146	7.13E-04	6%	6%	
0.4	46	9	94	102	33	0	55.146	9.50E-04	6%	11%	
0.7	46	9	84	92	33	0	55.146	8.31E-04	6%	18%	
1.4	46	9	68	75	42	0	42.420	7.01E-04	6%	24%	
2.8	36	9	43	47	42	33	42.358	1.39E-03	11%	33%	
5.7	49	7	15	16	16	6	16.251	1.39E-03	11%	46%	
11.3	18	11	0	0	0	4	0.237	1.39E-03	11%	57%	16
22.6	0	4	0	0	0	3	0.000	1.39E-03	11%	67%	
45.3	0	3	0	0	0	1	0.000	1.39E-03	11%	78%	
90.5	0	3	0	0	0	1	0.000	1.39E-03	11%	89%	
181.0	0	1	0	0	0	1	0.000	1.39E-03	11%	100%	
362.0	0	1									
	0	1	Total 403			Total 29.3	% Cap Used: [illegible]	Sum = 1.3E-02			

D50 16 mm

Table 12a. Reach 1 Transport Capacity Under Target Conditions

REACH INFORMATION: PARAMETERS AND CONSTANTS

Channel Width - w (m)	16
Slope - S (m/m)	0.0101
Wetted Perimeter - P (m)	16.9
Cross Section Area to WS - A (m^2)	10.4
Hydraulic Radius - R (m)	0.62
Depth of Scour = 1/3 R	0.21
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	61.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.09877
Median Grain Size - d50 (mm)	73
Percent of Bed < 1.4 mm	5%
Percent of Bed < 2.8 mm	8%
Percent of Bed < 5.7 mm	15%
Percent of Bed < 11 mm	18%

CAPACITY CHECK

Manning's n	0.066
Flow (cms)	11.5
Ada (m^2)	20.5
Flow (cms)	13.2
Percent Difference	-0.13

TRIBUTARY INPUT TO REACH

Ada (mi^2)	78.5
[illegible] (T/mi^2)	1.2
Input (% of Bkg)	30%
[illegible] (T/mi^2)	0.4
Background	95
Management	46

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13%	18.06
0.25	0.5	13%	18.06
0.5	1	13%	18.06
1	2	13%	18.06
2	4	10%	13.89
4	8	16%	22.22
8	16	6%	8.33
16	32	5%	6.95
32	64	5%	6.95
64	128	2%	2.78
128	256	2%	2.78
256	512	2%	2.78
		100%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

τ*median (dimless)	τ*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 3 year storm Qb total (Tonnes/yr)
5.00E-02	3.76E-02	1.33074	[illegible]	4.90E-05	0.00	3.80E+00	3.28E+02

PARTICLE SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	τ*ri ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi Qbi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	9.43E-05	556.330	1.1E+01	1.00E-02	176.269	1.38E-01	431.56	0.044	Yes
0.25	0.5	0.4	1.88E-04	300.370	1.1E+01	9.97E-03	175.002	1.57E-01	427.63	0.063	Yes
0.5	1	0.7	3.71E-04	153.740	1.1E+01	9.83E-03	172.597	1.54E-01	416.81	0.089	Yes
1	2	1.4	7.43E-04	97.149	1.1E+01	9.37E-03	167.085	1.50E-01	403.43	0.125	No
2	4	2.8	1.48E-03	23.714	1.0E+01	9.05E-03	138.797	1.47E-01	383.49	0.177	No
4	8	5.7	2.96E-03	18.937	9.0E+00	8.00E-03	142.040	1.37E-01	342.50	0.251	No
8	16	11	5.89E-03	8.499	7.1E+00	6.40E-03	113.276	1.00E-01	271.14	0.355	No
16	32	23	1.19E-02	4.287	4.3E+00	3.86E-03	67.749	6.00E-02	163.61	0.502	No
32	64	45	2.34E-02	2.162	1.3E+00	1.13E-03	20.103	1.80E-02	48.55	0.709	No
64	128	91	4.65E-02	1.076	6.9E-03	8.37E-06	0.110	9.84E-05	0.27	1.003	No
128	256	181	9.30E-02	0.540	3.1E-07	4.62E-10	0.000	7.18E-09	0.00	1.419	No
256	512	362	1.85E-01	0.271	5.8E-10	3.92E-13	0.000	8.20E-12	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (Tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles In Motion	cumulative % in Bed	Approx D50
0.2	0	18	Suspended	Suspended	18	0	Suspended	Suspended	Suspended	0%	
0.4	0	18	Suspended	Suspended	18	0	Suspended	Suspended	Suspended	0%	
0.7	0	18	Suspended	Suspended	18	0	Suspended	Suspended	Suspended	0%	
1.4	0	18	400	82	18	0	18.057	1.23E-05	3%	5%	
2.8	0	14	383	78	14	0	15.790	9.99E-06	4%	8%	
5.7	0	22	342	70	22	0	12.224	1.79E-05	7%	15%	
11.3	0	8	271	55	8	0	8.331	8.41E-06	3%	18%	
22.6	0	7	164	33	7	0	6.945	1.17E-05	4%	23%	
45.3	0	7	49	10	7	0	6.943	2.94E-05	13%	37%	73
90.5	0	3	0.3	0	0	3	0.034	5.80E-05	21%	58%	
181.0	0	3	0	0	0	3	0.000	5.80E-05	21%	79%	
362.0	0	3	0	0	0	3	0.000	5.60E-05	21%	100%	
			Total 1615			Total 8.3	% Cap Used: 13%	Ave = 2.7E-04			

Table 12b Reach 2 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS

Channel Width - w (m)	16
Slope - S (m/m)	0.0063
Wetted Perimeter - P (m)	14.3
Cross Section Area in WS - A (m^2)	11.5
Hydraulic Radius - R (m)	0.71
Depth of Scour = 1/3 R	0.24
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rhow (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	45.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*b)(m/s)	0.08484
Median Grain Size - d50 (mm)	30
Percent of Bed < 1.4 mm	9%
Percent of Bed < 2.8 mm	13%
Percent of Bed < 5.7 mm	21%
Percent of Bed < 11 mm	24%

GEOMETRY CHECK

Manning's n	0.04
Flow (cms)	12.7
Adr (m^2)	90
Flow (cms)	26.7
Percent Difference	-0.23
[illegible]	31

TRIBUTARY [illegible] TO REACH

Adr (mi^2)	13.5
[illegible]	2.4
[illegible]	64%
[illegible]	1.0
Background	33
[illegible]	14

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	3.99
0.25	0.5	13.00%	3.99
0.5	1	13.00%	3.99
1	2	13.00%	3.99
2	4	10.00%	4.61
4	8	16.00%	7.37
8	16	6.00%	2.76
16	32	5.00%	2.30
32	64	5.00%	2.30
64	128	2.00%	0.92
128	256	2.00%	0.92
256	512	2.00%	0.92
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

C*median (dimless)	C*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
3.31E-02	3.76E-02	1.42096	0.3[illegible]	1.09E-04	0.00	4.74E+00	4.09E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	C*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/s)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*rhos (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*b?)
0.125	0.25	0.2	9.30E-01	392.308	1.1E+01	8.35E-03	97.173	1.03E-01	275.93	0.044	Yes
0.25	0.5	0.4	2.71E-01	196.974	1.1E+01	6.29E-03	96.287	1.01E-01	273.37	0.063	Yes
0.5	1	0.7	5.40E-04	98.896	1.1E+01	6.17E-03	94.480	9.94E-02	268.30	0.089	No
1	2	1.4	1.08E-03	49.654	1.0E+01	5.94E-03	90.997	9.37E-02	258.43	0.125	No
2	4	2.8	2.14E-03	24.931	9.4E+00	5.51E-03	84.359	8.87E-02	239.55	0.177	No
4	8	5.7	4.23E-03	12.517	8.3E+00	4.72E-03	72.361	7.60E-02	205.20	0.251	No
8	16	11	8.50E-03	6.285	6.0E+00	3.41E-03	52.204	5.49E-02	148.25	0.355	No
16	32	23	1.60E-02	3.155	2.9E+00	1.65E-03	25.227	2.65E-02	71.64	0.502	No
32	64	45	3.37E-02	1.584	4.7E-01	2.41E-04	3.696	3.88E-03	10.50	0.709	No
64	128	91	6.77E-02	0.795	3.3E-03	3.31E-08	0.001	8.53E-07	0.00	1.003	No
128	256	181	1.34E-01	0.399	1.7E-06	9.94E-12	0.000	1.80E-10	0.00	1.419	No
256	512	362	2.66E-01	0.200	7.3E-11	4.46E-14	0.000	7.18E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (Tonnes/yr)	mass/velocity QVVi	% of Bed From Particles in Motion	cumulative % in Bed	Approx. D50
0.2	18	6	Suspended	Suspended	24	0	Suspended	Suspended	Suspende	0%	
0.4	18	6	Suspended	Suspended	24	0	Suspended	Suspended	Suspende	0%	
0.7	18	6	268	91	24	0	34.047	2.91E-05	3%	3%	
1.4	18	6	258	88	24	0	24.047	3.07E-05	3%	9%	
2.8	14	5	240	81	18	0	18.498	2.30E-05	4%	13%	
5.7	22	7	203	70	30	0	29.393	4.07E-05	7%	21%	
11.3	8	3	148	50	11	0	11.099	2.43E-05	4%	24%	
22.6	7	2	72	24	9	0	9.249	4.19E-05	7%	31%	
45.3	7	2	10	4	4	6	3.375	1.10E-04	17%	48%	
90.5	0	1	0	0	0	1	0.001	1.10E-04	19%	65%	D50 30 mm
181.0	0	1	0	0	0	1	0.000	1.10E-04	17%	83%	
362.0	0	1	0	0	0	1	0.000	1.10E-04	17%	100%	
			Total 1202			Total 8.5	% Cap Dead: 13%	Sum = 4.4E-04			

D50 30 mm

Table 12c Reach 3 Transport Capacity Under Target Conditions

HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	22
Slope - S (m/m)	0.00874
Wetted Perimeter - P (m)	23.4
Cross Section Area to WS - A (m^2)	19.6
Hydraulic Radius - R (m)	0.88
Depth of Scour = 1/3 R	0.29
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	75.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*b)(m/s)	0.10956
Median Grain Size - d50 (mm)	87
Percent of Bed < 1.4 mm	5%
Percent of Bed < 2.8 mm	9%
Percent of Bed < 5.7 mm	15%
Percent of Bed < 11 mm	18%

GEOMETRY CHECK	
Manning's n	0.055
Flow (cms)	30.5
Ads (m^2)	170
Flow (cms)	30.7
Percent Difference	-0.17

TRIBUTARY INPUT TO REACH	
Ads (mi^2)	80
Mgmt (Ton/mi^2)	1.1
Mgmt (% abv Bkg)	40%
Mgmt (Ton/mi^2)	0.8
Background	89
Management	48

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	16.49
0.25	0.5	13.00%	16.49
0.5	1	13.00%	16.49
1	2	13.00%	16.49
2	4	10.00%	12.69
4	8	16.00%	20.30
8	16	6.00%	7.61
16	32	5.00%	6.34
32	64	5.00%	6.34
64	128	2.00%	2.54
128	256	2.00%	2.54
256	512	2.00%	2.54
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	U*s median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
5.17E-02	3.76E-02	1.37412	0.13867	1.73E-04	0.00	1.01E+01	8.73E+02

GRAIN SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*s ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	2.93E-05	852.084	1.1E+01	1.37E-02	189.369	3.01E-01	811.38	0.014	Yes
0.25	0.5	0.4	1.58E-04	337.401	1.1E+01	1.36E-02	188.417	2.99E-01	806.82	0.063	Yes
0.5	1	0.7	3.14E-04	164.383	1.1E+01	1.35E-02	166.533	2.95E-01	797.80	0.099	Yes
1	2	1.4	6.28E-04	81.534	1.1E+01	1.33E-02	162.831	2.89E-01	780.06	0.125	No
2	4	2.8	1.25E-03	41.439	1.0E+01	1.26E-02	155.647	2.76E-01	745.65	0.177	No
4	8	5.7	2.49E-03	20.906	9.3E+00	1.15E-02	142.076	2.52E-01	680.63	0.251	No
8	16	11	4.95E-03	10.446	7.7E+00	9.54E-03	117.793	2.09E-01	564.31	0.355	No
16	32	23	9.85E-03	5.243	5.2E+00	6.41E-03	79.098	1.40E-01	378.93	0.502	No
32	64	45	1.96E-02	2.633	2.1E+00	2.58E-03	31.835	5.61E-02	151.50	0.709	No
64	128	91	3.93E-02	1.323	8.2E-02	1.14E-04	1.408	2.50E-03	6.74	1.003	No
128	256	181	7.78E-02	0.664	7.4E-06	9.12E-09	0.000	2.00E-07	0.00	1.419	No
256	512	362	1.55E-01	0.333	3.1E-09	3.85E-12	0.000	8.44E-11	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (Tonnes/yr)	mass/velocity QbVi	% of Bed From Particles in Motion	Cumulative % in Bed	Approx D50
0.2	24	16	Suspended	Suspended	41	0	Suspended	Suspended	Suspended	0%	
0.4	24	16	Suspended	Suspended	41	0	Suspended	Suspended	Suspended	0%	
0.7	24	16	Suspended	Suspended	41	0	Suspended	Suspended	Suspended	0%	
1.4	24	16	380	206	41	0	48.541	2.24E-05	5%	3%	
2.8	18	13	246	197	31	0	31.385	2.29E-05	4%	9%	
5.7	30	20	685	180	50	0	48.897	4.03E-05	7%	15%	
11.3	11	8	364	149	19	0	18.721	3.83E-05	3%	18%	
22.6	9	6	379	100	16	0	15.393	2.25E-05	4%	22%	
45.3	4	6	152	48	10	0	9.910	3.50E-05	6%	28%	87
90.5	0	3	7	2	2	1	1.780	1.44E-04	24%	52%	
181.0	0	3	0	0	0	3	0.000	1.44E-04	24%	76%	
362.0	0	3	0	0	0	3	0.000	1.44E-04	24%	100%	
			Total 3308			Total 5.8	% Cap Used: 19%	Sum = 4.0E-04			

Table 12F Reach 4 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS

Channel Width - w (m)	33
Slope - S (m/m)	0.01618
Wetted Perimeter - P (m)	33.5
Cross Section Area to WS - A (m^2)	19.1
Hydraulic Radius - R (m)	0.57
Depth of Scour = 1/3 R	0.19
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	91.0
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*) (m/s)	0.12069
Median Grain Size - d50 (mm)	113
Percent of Bed < 1.4 mm	6%
Percent of Bed < 2.8 mm	11%
Percent of Bed < 5.7 mm	18%
Percent of Bed < 11 mm	24%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	42.9
A/s (m^2)	192
Flow (cms)	42.8
Percent Difference	0.42

TRIBUTARY INPUT TO REACH

A/s (mi^2)	11
Bkgrnd T/mi^2y	3.9
Mgmt (% abv Bkg)	30%
Mgmt (T/mi^2y)	9.9
Background	21
Management	10

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	4.06
0.25	0.5	13.00%	4.06
0.5	1	13.00%	4.06
1	2	13.00%	4.06
2	4	10.00%	3.12
4	8	16.00%	4.99
8	16	6.00%	1.87
16	32	5.00%	1.56
32	64	5.00%	1.56
64	128	2.00%	0.62
128	256	2.00%	0.62
256	512	2.00%	0.62
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

T*median (dimless)	T*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
4.83E-02	3.76E-02	1.2905E	[illegible]	1.16E-04	0.00	1.04E+01	8.97E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	T*i ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi Qbi(vol)*Mass (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	8.14E-01	398.403	1.1E+01	1.30E-02	345.765	6.08E-01	1636.06	0.044	Yes
0.25	0.5	0.4	1.22E-01	398.698	1.1E+01	1.83E-02	344.141	6.03E-01	1628.43	0.063	Yes
0.5	1	0.7	2.44E-01	199.175	1.1E+01	1.87E-02	340.963	5.90E-01	1653.43	0.089	Yes
1	2	1.4	4.03E-02	100.003	1.1E+01	1.70E-02	334.703	5.87E-01	1583.81	0.125	No
2	4	2.8	9.40E-02	50.240	1.0E+01	1.71E-02	322.500	5.63E-01	1526.07	0.177	No
4	8	5.7	3.92E-03	25.210	9.6E+00	1.59E-02	299.229	5.24E-01	1415.95	0.251	No
8	16	11	3.83E-03	12.657	8.3E+00	1.36E-02	256.780	4.50E-01	1215.08	0.355	No
16	32	23	7.66E-03	6.353	6.0E+00	9.89E-03	186.249	3.26E-01	881.33	0.502	No
32	64	45	1.52E-03	3.191	2.9E+00	4.83E-03	90.909	1.39E-01	430.18	0.709	No
64	128	91	3.03E-03	1.602	4.3E-01	7.26E-04	13.851	2.43E-02	65.54	1.003	No
128	256	181	4.03E-03	0.804	1.1E-01	1.79E-07	0.003	5.92E-06	0.02	1.419	No
256	512	362	1.20E-03	0.404	1.9E-08	3.21E-11	0.000	1.06E-09	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qi/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
0.2	41	4	Suspended	Suspended	45	0	Suspended	Suspended	Suspended	0%	
0.4	41	4	Suspended	Suspended	45	0	Suspended	Suspended	Suspended	0%	
0.7	41	4	Suspended	Suspended	45	0	Suspended	Suspended	Suspended	0%	
1.4	41	4	1381	200	45	0	14.597	1.32E-03	6%	6%	
2.8	31	3	1526	192	34	0	34.303	1.21E-03	5%	11%	
5.7	30	3	1416	178	33	0	34.808	2.09E-03	9%	20%	
11.3	19	2	1215	153	21	0	20.583	9.15E-04	4%	24%	
22.6	16	2	881	111	17	0	17.333	1.01E-03	4%	29%	
45.3	10	2	430	54	11	0	11.478	1.47E-05	6%	35%	
90.5	2	1	66	8	2	0	2.404	1.88E-05	8%	43%	D50 113 mm
181.0	0	1	0	0	0	0	0.002	6.81E-03	20%	71%	
362.0	0	1	0	0	0	1	0.000	6.81E-03	29%	100%	
			Total 3118			Total 1 2	% Cap Used: 31%	Sum = 1.4E-02			

D50 113 mm

Table 12e Reach 3 Transport Capacity Under Target Conditions

REACH HYDRAULIC PARAMETERS AND CONSTANTS

Channel Width - w (m)	25
Slope - S (m/m)	0.00109
Wetted Perimeter - P (m)	26.1
Cross Section Area to WS - A (m^2)	32.2
Hydraulic Radius - R (m)	1.23
Depth of Scour = 1/3 R	0.41
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	13.4
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*k)(m/s)	0.07735
Median Grain Size - d50 (mm)	48
Percent of Bed < 1.4 mm	10%
Percent of Bed < 2.8 mm	15%
Percent of Bed < 5.7 mm	24%
Percent of Bed < 11 mm	28%

GEOMETRY CHECK

Manning's n	0.035
Flow (cms)	58.8
Area (m^2)	245
Flow (cms)	58.6
Percent Difference	0.00

TRIBUTARY INPUT TO REACH

Area (mi^2)	53
Bkgrnd T/mi^2	1.3
Mgmt (% abv Bkg)	36%
Mgmt (T/mi^2)	0.7
Background	69
Management	39

Input Particle Sizes

min (mm)	max (mm)	Percentage	Tonnes/yr
0.125	0.25	13.00%	14.03
0.25	0.5	13.00%	14.03
0.5	1	13.00%	14.03
1	2	13.00%	14.03
2	4	10.00%	10.80
4	8	16.00%	17.27
8	16	6.00%	6.48
16	32	5.00%	5.40
32	64	3.00%	3.24
64	128	2.00%	2.16
128	256	2.00%	2.16
256	512	2.00%	2.16
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

t*median (dimless)	t*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
5.61E-02	3.76E-02	1.49849	0.29553	1.20E-04	0.00	8.73E+00	7.53E+02

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	t*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi M(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*k?)
0.125	0.25	0.2	1.21E-04	320.566	3.3E+01	4.80E-03	42.839	1.21E-01	328.74	0.044	Yes
0.25	0.5	0.4	2.44E-04	183.975	1.2E+01	4.73E-03	41.367	1.20E-01	323.08	0.063	Yes
0.5	1	0.7	4.91E-04	93.326	1.1E+01	4.64E-03	40.641	1.17E-01	315.88	0.089	No
1	2	1.4	1.36E-03	41.336	1.0E+01	4.44E-03	38.843	1.12E-01	301.91	0.125	No
2	4	2.8	2.71E-03	20.734	9.1E+00	4.05E-03	35.448	1.02E-01	275.32	0.177	No
4	8	5.7	5.41E-03	10.420	7.1E+00	3.36E-03	29.376	8.40E-02	228.33	0.251	No
8	16	11	1.08E-02	5.232	5.2E+00	2.23E-03	19.703	5.87E-02	153.14	0.355	No
16	32	23	2.14E-02	2.633	2.1E+00	8.97E-04	7.854	2.26E-02	61.04	0.502	No
32	64	45	4.27E-02	1.319	9.0E-02	3.91E-05	0.342	9.85E-04	2.66	0.709	No
64	128	91	8.51E-02	0.662	7.7E-06	3.10E-09	0.000	7.82E-08	0.00	1.003	No
128	256	181	1.99E-01	0.332	3.1E-09	1.33E-12	0.000	3.34E-11	0.00	1.419	No
256	512	362	3.38E-01	0.167	2.9E-11	1.36E-14	0.000	3.10E-13	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr)	mass/velocity Qb/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
0.2	45	14	Suspended	Suspended	59	0	Suspended	Suspended	Suspende	0%	
0.4	45	14	Suspended	Suspended	59	0	Suspended	Suspended	Suspende	0%	
0.7	45	14	316	178	59	0	58.031	1.65E-04	5%	5%	
1.4	45	14	302	170	59	0	58.611	1.77E-04	5%	10%	
2.8	34	11	276	155	45	0	45.106	1.45E-04	4%	15%	
5.7	55	17	228	139	72	0	72.181	2.00E-04	9%	24%	
11.3	21	6	153	86	27	0	27.000	1.57E-04	5%	28%	
22.6	17	5	61	34	23	0	23.350	3.20E-04	10%	38%	D50 48 mm
45.3	11	5	3	1	1	15	1.495	4.99E-04	13%	54%	
90.5	7	2	0	0	0	5	0.000	4.99E-04	15%	69%	
181.0	0	2	0	0	0	2	0.000	4.39E-04	15%	85%	
362.0	0	2	0	0	0	2	0.000	4.99E-04	15%	100%	
			Total 1338			Total 24.3	% Cap Shed: 39%	Sum = 3.3E-03			

D50 48 mm

Table 121 Reach 6 Transport Capacity Under Target Conditions

REACH HYDRAULIC RESULTS AND CONSTANTS	
Channel Width - w (m)	38
Slope - S (m/m)	0.001
Wetted Perimeter - P (m)	39
Cross Section Area to WS - A (m^2)	31
Hydraulic Radius - R (m)	1.19
Depth of Scour = (?) R	0.80
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - tb (Pa)	12.6
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*b)(m/s)	0.05300
Median Grain Size d50 (mm)	17
Percent of Bed < 1.4 mm	14%
Percent of Bed < 2.8 mm	22%
Percent of Bed < 5.7 mm	33%
Percent of Bed < 11 mm	44%

GEOMETRY CHECK	
Manning's n	0.033
Flow (cms)	93.5
Adr (m^2)	310
Flow (cms)	79.2
Percent Difference	0.19

TRIBUTARY INPUT TO REACH	
Adr (mi^2)	65
Elgrnd T/mi^2	0.8
Mgmt (% ...)	78%
Mgmt (T/mi^2)	0.2
Background	33
Management	14

Input Particle Size min (mm)	max (mm)	Percentage (min)	Tonnes/yr
0.125	0.25	13.00%	8.92
0.25	0.5	13.00%	8.92
0.5	1	13.00%	8.92
1	2	13.00%	8.92
2	4	10.00%	8.86
4	8	16.00%	10.98
8	16	6.00%	4.12
16	32	5.00%	3.43
32	64	5.00%	3.43
64	128	2.00%	1.37
128	256	2.00%	1.37
256	512	2.00%	1.37
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

T*median (dimless)	T*s median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
6.19E-02	3.76E-02	1.64687	8.30E+00	1.00E-03	0.00	7.38E+00	6.27E+02

EACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	T*s ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi M(out)^ih (kg/s)	Particle Fall Velocity Wf (m/s)	Particle Suspended? (Wf > U*b?)
0.125	0.25	0.2	4.07E-04	134.075	1.1E+01	1.33E-03	9.393	5.83E-02	158.08	0.042	Yes
0.25	0.5	0.4	8.00E-03	37.339	1.1E+01	1.49E-03	8.903	5.72E-02	154.33	0.063	No
0.5	1	0.7	3.39E-03	38.841	1.0E+01	1.43E-03	8.363	5.45E-02	147.01	0.089	No
1	2	1.4	3.17E-03	19.398	9.2E+00	1.39E-03	7.746	4.94E-02	133.41	0.125	No
2	4	2.8	6.32E-03	9.791	7.3E+00	1.02E-03	6.333	4.04E-02	109.14	0.177	No
4	8	5.7	1.26E-02	4.916	4.9E+00	6.86E-04	4.338	2.63E-02	71.08	0.231	No
8	16	11	2.51E-02	2.468	1.8E+00	2.57E-04	1.374	9.69E-03	26.17	0.355	No
16	32	23	5.00E-02	1.239	4.4E-02	6.13E-06	0.037	2.35E-04	0.64	0.501	No
32	64	45	9.93E-02	0.622	3.1E-06	4.34E-10	0.000	1.67E-08	0.00	0.709	No
64	128	91	1.98E-01	0.312	1.8E-09	2.49E-13	0.000	9.37E-12	0.00	1.003	No
128	256	181	3.95E-01	0.157	2.2E-11	3.00E-15	0.000	1.15E-13	0.00	1.419	No
256	512	362	7.86E-01	0.079	2.0E-12	3.76E-16	0.000	1.36E-14	0.00	2.006	No

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s)	Parker Potential Movement (Tonnes/yr)	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonne/yr)	massvelocity Q/Vi	% of Bed From Particles in Motion	cumulative % in Bed	Approx D50
			Suspended	Suspended	48	0	Suspended	Suspended	Suspends	0%	
0.2	39	9	154	151	48	0	47.335	8.58E-04	5%	5%	
0.4	39	9	147	144	48	0	47.335	9.01E-04	5%	10%	
0.7	39	9	133	130	48	0	47.335	9.95E-04	4%	16%	
1.4	39	7	109	107	33	0	31.965	5.34E-04	5%	22%	
2.8	45	11	71	69	69	14	69.437	1.93E-03	11%	33%	D50 17 mm
5.7	73	4	26	26	26	6	35.362	1.93E-03	11%	44%	
11.3	27	3	1	1	1	25	0.820	1.93E-03	13%	55%	
22.6	23	3	0	0	0	3	0.000	1.93E-03	12%	66%	
45.3	1	1	0	0	0	1	0.000	1.93E-03	11%	78%	
90.5	0	1	0	0	0	1	0.000	1.93E-03	11%	89%	
181.0	0	2	0	0	0	1	0.000	1.93E-03	13%	100%	
362.0	0	1	0								
			Total 642			Total 53.7	% Cap Used 34%	Sum = 1.78E-01			D50 17 mm

Table 17a. Reach 7 Transport Capacity Under Target Conditions

REACH HYDRAULIC PARAMETERS AND CONSTANTS

Channel Width - w (m)	76.5
Slope - S (m/m)	0.00108
Wetted Perimeter - P (m)	78.2
Cross Section Area to WS - A (m^2)	47.5
Hydraulic Radius - R (m)	1.68
Depth of Scour = 1/3 R	0.56
Acceleration of Gravity - g (m/s^2)	9.81
Density of Water - rho (kg/m^3)	1000
Bed Shear Stress - τb (Pa)	16.7
Density of Sediment - rhos (kg/m^3)	2700
Shear Velocity (U*b)(m/s)	0.05107
Median Grain Size - d50 (mm)	15
Percent of Bed < 1.4 mm	18%
Percent of Bed < 2.8 mm	25%
Percent of Bed < 5.7 mm	36%
Percent of Bed < 11 mm	46%

GEOMETRY CHECK

Manning's n	0.027
Flow (cms)	79.1
Adr (mi^2)	341
Flow (cms)	89.4
Percent Difference	-0.12

TRIBUTARY INPUT TO REACH

Adr (mi^2)	33
Bkgrnd T/mi^2	2.2
Mgmt (% abv Bkg	48%
Mgmt (T/mi^2)	1.1
Background	68
Management	33

Input Particle Sizes

min (mm)	max (mm)	Percentage (mm)	Tonnes/yr
0.125	0.25	13.00%	13.12
0.25	0.5	13.00%	13.12
0.5	1	13.00%	13.12
1	2	13.00%	13.12
2	4	10.00%	10.09
4	8	16.00%	16.15
8	16	6.00%	6.05
16	32	5.00%	5.05
32	64	5.00%	5.05
64	128	2.00%	2.02
128	256	2.00%	2.02
256	512	2.00%	2.02
		100.00%	

PARKER EQUATION TOTAL BEDLOAD TRANSPORT

τ*median (dimless)	τ*r median (dimless)	phi_median (dimless)	W*median (dimless)	qb median (m^2/s)	Qb total (m^3/s)	Qb total (kg/s)	For 2 year storm Qb total (Tonnes/yr)
6.90E-03	3.74E-02	1.85553	0.37347	1.00E-04	0.00	7.36E+00	6.18E+05

REACH SIZE CLASS TRANSPORT CALCULATIONS

Minimum Grain Size in Fraction (mm)	Maximum Grain Size in Fraction (mm)	Geometric Mean of Grain Size in Fraction (mm)	τ*r ith fraction	phi ith fraction	W*i	Parker Potential Movement per unit width qbi (m^2/s)	Parker Particle Velocity Vi (m/hr)	Parker Potential Volume Qbi qbi*w (m^3/s)	Potential Mass Qbi bi(vol)*rh (kg/s)	Particle Fall Velocity Ws (m/s)	Particle Suspended? (Ws > U*b?)
0.125	0.25	0.2	4.71E-04	146.629	1.1E+01	1.41E-03	9.052	3.74E-02	101.01	0.044	Yes
0.25	0.5	0.4	9.37E-04	73.620	1.1E+01	1.38E-03	8.826	3.63E-02	98.50	0.063	No
0.5	1	0.7	1.87E-03	36.963	1.0E+01	1.31E-03	8.390	3.47E-02	93.83	0.089	No
1	2	1.4	3.73E-03	18.559	9.1E+00	1.18E-03	7.572	3.13E-02	84.49	0.125	No
2	4	2.8	7.41E-03	9.318	7.7E+00	9.56E-04	6.127	2.53E-02	68.37	0.177	No
4	8	5.7	1.48E-02	4.678	4.7E+00	6.07E-04	3.891	1.61E-02	43.43	0.251	No
8	16	11	2.94E-02	2.349	1.6E+00	2.08E-04	1.337	5.52E-03	14.92	0.355	No
16	32	23	5.85E-02	1.179	3.4E-02	3.06E-06	0.020	8.11E-05	0.22	0.502	No
32	64	45	1.17E-01	0.592	1.8E-06	2.31E-10	0.000	5.39E-09	0.00	0.709	No
64	128	91	2.32E-01	0.297	1.2E-09	1.53E-13	0.000	4.07E-12	0.00	1.003	No
128	256	181	4.62E-01	0.149	3.7E-11	2.22E-15	0.000	5.88E-14	0.00	1.419	No
256	512	362	9.32E-01	0.075	1.0E-12	2.27E-16	0.000	6.01E-15	0.00	2.006	No
							0.000				

Geometric Mean of Grain Size in Fraction (mm)	Primary Input (Tonnes/yr)	Tributary Input (Tonnes/yr)	Parker Relative Movement (Kg/s) Suspended	Parker Potential Movement (Tonnes/yr) Suspended	Output (Tonnes/yr)	Deposited (Tonnes/yr)	Bedload (tonnes/yr) Suspended	mass/velocity Qb/Vi Suspended	% of Bed From Particles in Motion Suspende	cumulativ % in Bed	Approx D50
0.2	68	13	98	151	81	0	80.674	1.04E-03	6%	0%	
0.4	68	13	98	143	81	0	80.674	1.10E-03	6%	6%	
0.7	68	13	84	129	81	0	80.674	1.22E-03	7%	12%	
1.4	68	13	68	105	81	0	62.057	1.16E-03	6%	18%	
2.8	52	10	43	67	62	0	46.537	1.93E-03	11%	23%	
5.7	69	16	15	23	67	19	22.854	1.93E-03	11%	34%	
11.3	26	6	0	0	23	9	0.336	1.93E-03	11%	46%	45
22.6	3	5	0	0	0	5	0.000	1.93E-03	11%	57%	
45.3	0	5	0	0	0	5	0.000	1.93E-03	11%	68%	
90.5	0	2	0	0	0	2	0.000	1.93E-03	11%	79%	
181.0	0	2	0	0	0	2	0.000	1.93E-03	11%	89%	
362.0	0	2	0	0	0	2				100%	
			Total 484			Total 44.2	% Cap Used 38%	Sum = 1.68E-02			